STAFF WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:)
)
2005 BUILDING ENERGY EFFICIENCY)
STANDARDS)
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CALIFORNIA ENERGY COMMISSION

1516 NINTH STREET

HEARING ROOM A

SACRAMENTO, CALIFORNIA

THURSDAY, MAY 30, 2002

10:00 A.M.

Reported by:
Valorie Phillips
Contract No. 150-01-005

COMMISSIONERS, ADVISORS PRESENT

Arthur Rosenfeld, Commissioner

STAFF PRESENT

William Pennington

Bryan Alcorn

Maziar Shirakh

ALSO PRESENT

Charles Eley
Eley Associates

Bruce Wilcox
Berkeley Solar Group

Ken Nittler
EnerComp, Inc.

Mark Hydeman
Taylor Engineering

Douglas Mahone
Nehemiah Stone
Jon McHugh
Charles Ehrlich
Heschong Mahone Group

A.Y. Ahmed
Occidental Analytical Group
Consultant to Southern California Gas Company

Patrick Eilert
Marshall Hunt
Misti Bruceri
Pacific Gas and Electric Company

Karim Amrane
Air Conditioning and Refrigeration Institute

Kurt Kaufman
Lisa Fabula
San Diego Gas and Electric

ALSO PRESENT

Gregg Ander
Southern California Edison Company

Robert E. Raymer
California Building Industry Association

Jim Lutz
Hasheem Akbari
Lawrence Berkeley National Laboratory

Robert G. Scichili
Michelle Vondran
BASF Corporation

Rachel Ann Harcharik
Robert M. Ramirez
RER

Tony Pierce
Southern California Edison Company

Thomas Trimberger
California Building Officials

Gary Fernstrom
Pacific Gas and Electric Company

Steven D. Gates
James J. Hirsch & Associates

Bill Mattinson
Sol-Data Energy Consulting
California Association of Building Energy
Consultants

Michael S. Day
Beutler Heating & Air Conditioning

Michael Gabel
Gabel Associates
California Association of Building Energy
Consultants

Ray Bjerrum
Merzon Industries
Atmos Corporation

ALSO PRESENT

Noah Horowitz
Natural Resources Defense Council

Mark Modera
Aeroseal

Michael M. Ray
The Trane Company

Tom Hamilton
California Home Energy Efficiency Rating System

Dave Ware
Owens Corning
representing NAIMA

Jamie Khan
The Apex Group
Lennox International

Jerry Blomberg
SunOptics Skylights

Ron Bergeson
HCD

Steven C. Ainsworth
The Skunk Works

Rachael Boydston
DayLite

Robert W. Lucas
Lucas Advocates

Stephen Frantz
Sacramento Municipal Utility District

I N D E X

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P R O C E E D I N G S

10:00 a.m.

MR. ALCORN: I'd like to welcome everyone to today's workshop. My name is Bryan Alcorn; I'm the Contract Manager for this round of the building standards. I wanted to acknowledge a few people.

Bill Pennington to my right, who's the Project Technical Lead for the 2005 building standards. And to his right, Charles Eley, who is the Commission's prime contractor for this work.

Also I would like to welcome the Commissioners' Offices. I think they may be listening in and hopefully will join us later on today. Commissioner Pernell and Commissioner Rosenfeld, as well as their Advisors.

The purpose of the workshop today is to discuss the second group of measure analysis reports. There will be eight reports presented today. And they will be discussed in the order that they show up on the agenda.

The format for the workshop today is that each topic will have 45 minutes maximum. And in that time, 15 minutes will be for the presentation of the fundamentals of the proposed measure. And then the remaining 30 minutes will be for questions and comments.

Because we have a very packed agenda today, I may interrupt. I'm apologizing ahead of time that I may need to interrupt to keep up on the agenda.

I want to make a comment about future workshops. I sent out a broadcast email. I'm saying that the next workshop, which is scheduled for June 13th, is canceled as of earlier this week. We're going to have back-to-back workshops in July, Thursday, July 18th and Friday, July 19th. So those will be the next two workshops. They will be back-to-back, and we will be finishing the remainder of the measure reports at those two workshops.

There are a couple of housekeeping items that I want to discuss. I actually want to point out and introduce he recorder today, Valorie Phillips, if you could raise your hand. We have eight microphones that are going to the recorder. There are actually two per bank of the circle of tables, so two microphones.

The microphones, incidentally, are these smaller microphones, so when you make a comment, please, if you could identify yourself, and if you're not near one of these recorder microphones, if you could approach one, state your name for the recorder and then make your comments.

Also, if you think you're going to be making comments today, if you could get a business to Valorie. That would be useful, so we can get your name right on the transcripts.

That is pretty much all that I have to say, so I guess we can get into this meeting. I see there's a question. Bill?

MR. RAYMER: Bob.

MR. ALCORN: Or Bob, I'm sorry.

MR. RAYMER: Bob Raymer with the Building Industry Association. Two meetings ago a big concern of ours was getting our hands on analysis tools, particularly a copy of MICROPAS with the TDV modifications.

We were told that it would be ready within days. Needless to say, it's not. And it's my understanding that, well, Ken obviously needs to be paid for his time and his efforts. We need to get access to an analysis tool.

There's a great many of the players here that are looking at individual items, and the impact of those individual items. Obviously there's a few of us, particularly CBIA, that's going to be very interested in the whole-house approach, to say the least.

And so without access to that, we're kind of -- we're going to be running blind here. And it's very important that we get access to this immediately.

Now, if it's a question of payment we would prefer to not have to pay for it, but if it comes to that, we'll do what we have to do. It seems that as far as the development process, the state should be making available for those that needs it some type of an analysis tool.

So, perhaps we could hear from Ken where things are, what things cost, et cetera?

MR. NITTLER: I do have a working version of MICROPAS that has all the time-dependent valuation and a majority of the other changes that have been proposed so far.

I've been working with the folks at Pacific Gas and Electric and Southern California Edison to fund that effort so that we can provide copies to many of the stakeholders.

I don't know if Tony or Gary could say

something about where that is in the process?

MR. FERNSTROM: Gary Fernstrom, Pacific Gas and Electric. Indeed, PG&E has been working with Ken to give him a purchase order for copies of MICROPAS with TDV capability that would be available to selected individuals.

However, as I understand it, HMG developed a spreadsheet version which may not be as convenient to use, but is currently available on their website. And anyone wishing to do that sort of analysis should be fully capable of doing it using that spreadsheet version that's available on HMG's website.

MR. PENNINGTON: My comment related to that, Gary, is that the tool on HMG's website does not include the recommendations that the Commission is making regarding modeling assumption changes for residential.

And so you're likely to get results using that technique that's not going to match up with what ultimately compliance will be based on.

MR. FERNSTROM: Okay. So we've been trying to keep up with all of the changes, and the current version we have may not include all of those changes that have been made outside of the

TDV work, itself.

MR. PENNINGTON: Right.

MR. MAHONE: Yeah, the spreadsheet implements the TDV part, but there have been a number -- this is Doug Mahone from HMG -- the spreadsheet implements the TDV economics approach, but the engineering assumptions that have been changed subsequent to the development of the TDV proposal have to be implemented within MICROPAS, which is, I think, what Bob's original comment referred to.

MR. RAYMER: We want something that's going to give us relatively accurate -- I agree with you, Bill, if something's not as up to date as possible I don't want my consultants spending time and a whole lot of money working on it.

Consequently, I'm looking for some advice here at this point, because we're starting to head into the depth of this proceeding. And we want to be able to start giving some very substantive input. And without that tool, I can't tell them to give best guesses. We don't have the money to do that.

I need an analysis tool. So, do we have any idea of time, when? And if the funds aren't there, what does CBIA need to do?

I mean I'd rather not go down that road at this part of the public process, but I guess asking Ken what needs to happen?

MR. NITTLER: I need to get those POs out of our friends out of the utilities.

MR. PIERCE: Tony Pierce with Southern California Edison. And, Bob, we are -- the purchase order to Ken to do this is forthcoming very shortly. And we've been collaborating, as Gary said, with PG&E to get this work done.

MR. RAYMER: Okay. Thanks. I'll pass that on to Rob, thanks.

MR. AHMED: A.Y. Ahmed, Consultant to Southern California Gas. We have the same concerns and we share the same concerns with CBIA. We've been waiting for our version to do our own analyses.

MR. PENNINGTON: Would The Gas Company be willing to share the pain here?

MR. AHMED: I don't think so. The last time I talked with Lance when he was involved, he did not have any money. I don't know at this point. We can check.

MR. RAYMER: Would it be appropriate to

discuss dollars right now, or later during lunch or whatever?

MR. PENNINGTON: Well, what I'm hearing, Bob, is that there's progress being made on this. And it will be resolved shortly.

MR. RAYMER: Okay, thank you.

MR. FERNSTROM: Let me say, Bob, we have the message that there's an urgent need for this, and we're working on it as quickly as we can.

MR. ALCORN: Okay, thanks. I think we should get on to the first presentation now, which will be Doug Mahone.

MR. MAHONE: Okay, thank you very much. The topic here is residential hardwired lighting. Just to make sure everybody's on the same page here, there's a copy of my presentation that's out on the front table. And there's also a copy of the PG&E case report on the residential hardwired lighting out there.

And since we've only got 15 minutes I've chosen, for the presentation, not to go into the nitty-gritty of how we did our analysis, but instead just to focus on how the requirements would change.

And if you actually want to follow along in chapter-and-verse, page 11 in the case initiative shows the existing standards language and the proposed standards language for the residential hardwired lighting with underline and strikeout. And my presentation basically is going to walk through that.

There are several objectives here. One is that the residential lighting area has been kind of a knotty and problematic area of Title 24 for a long time. We've gotten a lot of feedback and a lot of attempts to clarify how -- a lot of feedback that it's difficult to enforce, or people object to the requirements, or it's unclear what they are.

So, one of our objectives is to improve the clarity and enforceability.

Second, of course, since this is an energy efficiency standard, is to improve the efficiency of residential lighting.

And then the third objective is to recognize that the technology for residential lighting has been improving dramatically over the last several years. The utilities have spent literally millions of dollars in encouraging the use of compact fluorescent lighting for residential applications.

And a lot of the market data that has been generated indicates that that market is taking off. There's also a lot of work at the federal level with EnergyStar efficient lighting lamps, ballasts and fixtures, which are currently very actively promoting these technologies.

And by the time this standard kicks in in 2005, there will be even more product availability; more options than the already fairly ample options available now.

So, let's start then with the definition of a high efficacy luminaire, which is sort of the nub of this proposal.

For a long time now Title 24 has defined a high efficacy luminaire as on the basis of the lamp efficacy, pegging that at greater than or equal to 40 lumens per watt. And it's also limited this to what we call pin-based fluorescents as opposed to the screw-in types. And it's required that they be switched separately from the regular incandescent lighting.

We're basically stuck with the same intent with our proposal; however, as the technology has improved, we found that we can actually be a little more precise about what we mean by a high efficacy lamp.

As you get into the higher wattage lamps, higher than 15 watts, the current technology with lamps and ballasts allows you to have higher lumens per watt limits. So, within the 15 to 40 watt range we've set it at 50 lumens per watt; and higher than 40 watts, which is basically getting into the standard four-foot type lamps, it needs to be at least 60 lumens per watt.

Next issue then is for bathrooms. The current requirements say that bathrooms must have at least one high efficacy luminaire. And if you don't want to do that, you can do a tradeoff. You can instead install a high efficacy luminaire in a garage or utility room or a laundry room. And you have to make the outdoor lighting either high efficacy or controlled by motion sensor.

And if you exercise this tradeoff for more than one bathroom in the house, you know, for the first bathroom maybe you put a high efficacy luminaire in the garage. For the second bathroom maybe you put it in the laundry room. Third bathroom maybe you put it in the utility room.

There's basically two problems with

this. One is that people are pretty much already doing that, putting fluorescents in those rooms. And the second is that it's missing the opportunity to save the energy. The bathroom is actually one of the highest use areas in the house. And there's a lot of opportunity to save energy there.

So, our first proposal for bathrooms is to eliminate that tradeoff.

Our second proposal is a definition change. The current definition of a bathroom is any room with a shower or tub. But that has turned out to leave a lot of loopholes because there are a lot of people that, you know, put the toilet in a separate room, or have sinks in separate rooms.

So, we've expanded the definition to include any of those fixtures. And we made one kind of addendum to that, which is that the sink is a sink for personal hygiene. The reason for that is we didn't want people saying, well, there's a sink in the wetbar there in the family room, therefore that must fall under the bathroom definition. So we didn't want to suck wetbars in there. And those are not sinks for personal hygiene.

MR. RAYMER: Can I ask you a question? When you're making, or proposing these modifications to the definition, what if you've got a case where you've got the lavatory that's immediately adjacent to a room that can actually be enclosed by a door that's got the water closet and the tub, or tub/shower combination?

Would you want fluorescent in both of those?

MR. MAHONE: Yes. So the second part, the second bullet here is that we're proposing that all the lighting in bathrooms be high efficacy lighting with one exception. If you want to use incandescent lighting or some other kind of lighting that's not high efficacy lighting, that that lighting be controlled with an occupancy sensor.

And the type of occupancy sensor that has a manual-on switch. So basically you turn it on the way you turn on any light when you walk into the room. But then the motion sensor will shut it off for you if you leave the room.

And the technology for these manual-on occupancy sensors is, at this point, quite mature;

and these are available at very reasonable cost. So that's the exception.

The basic requirement is to put high efficacy lighting in the bathrooms.

Next, the other kind of corollary to this is where essentially extending that same requirement to the utility, the laundry room and the garage. We're saying that those lights, the lights in those rooms need to be high efficacy. If you want to use incandescents, you use the same kind of occupancy sensor control on the incandescents. So, this is again part of eliminating that tradeoff, which is what it is now.

Next. Outdoor lighting, right now the only requirement on residential outdoor lighting is if you use it as a tradeoff to avoid putting high efficacy lighting in a bathroom. We're changing that requirement to say that all outdoor lighting must either be high efficacy lighting or it has to be controlled by a motion sensor/photo control combo.

The motion sensor/photo control combo, the photo control is there just to make sure these lights don't come on during the daylight hours.

And the motion sensor part is that they only come on when there's somebody moving around out there, which is actually a more secure way to control these things anyway. Because it's dark until somebody starts moving around, and then the light turns on.

So, we would eliminate this tradeoff, again, with the bathrooms. We keep the definition that outdoor lighting is the stuff that's permanently mounted to the building. We're not interested in regulating low voltage landscape lighting through this requirement, for example. And we're also putting in exceptions for pools and water features and things like that that have special requirements under the electrical code.

The photo control addition here goes beyond the current requirement which says if you use incandescent lighting outdoors it has to be controlled by a motion sensor. And, again, this is just a commonsense thing that photo control keeps the lights off during the daytime hours.

These kinds of controls are readily available. You can walk into any hardware store or any Home Depot and find outdoor lighting fixtures that have this kind of photocell motion control.

On to kitchen lighting. Kitchen lighting is currently very confusing to a lot of people. The intention is that the general lighting in the kitchen has to be high efficacy lighting. And the current standard further goes on to say that by general lighting we mean it has to be sufficient to provide adequate light for cooking activities; and it has to be relatively uniform. These are all criteria that are kind of hard for building officials to identify and enforce.

And that the current standards allow for other kinds of non high efficacy lighting to be used in kitchens, basically without limit. And what's happening is people are just putting lots of small incandescents into kitchens these days. Putting them in down-lights, putting them in track lights, putting them in little button incandescents that they screw up under the cabinets and so forth.

And so there's a lot of lighting that's going into kitchens that is very low efficiency lighting.

So the new proposal is that all kitchen

fixtures be high efficacy. However, we would allow up to 50 percent of the watts in the kitchen to be non high efficacy lighting if those watts are controlled by separate switches.

So, you can still put in recessed cans; you can still put in pin spots; you can still put in all the decorative stuff if you want to. It's just that there's now a limitation on the amount of wattage that's being used for doing that. And it's tied to 50 percent of the total watts installed in the kitchen.

Because the high efficacy lighting gives you a lot more light for the same watts, the effect of this will be to greatly encourage the use of the high efficacy lighting wherever it's possible, and restrict the use of the incandescent stuff to where you really want it for decorative effects, or for impact.

Next, please. We're also proposing a general requirement for tract lighting, recessed lighting and pendant lighting, which is not currently mentioned in the standards. And this is a requirement that these types of fixtures must be high efficacy wherever they occur in the home unless they're controlled by a dimmer switch.

So this will not prevent somebody from putting a chandelier in a dining room; they just have to put it on a dimmer, which most people do, anyway. So this is basically trying to encourage, again, the use of high efficacy lighting throughout the home.

Finally, the last item on the next slide has to do with recessed luminaires. These are the recessed can kinds of fixtures which are increasingly popular. The requirement here is when these fixtures are installed in an insulated ceiling, if it's not done correctly what you end up with is a big uninsulated hole in the ceiling that also leaks air. And so a lot of energy is lost.

The current requirement sort of recognizes that. It says that these fixtures have to be IC rated, which is insulation contact rated. In other words, they don't burn up if you put the insulation over them.

So, we're keeping that requirement, but we're adding an air tightness requirement. So these are essentially what are known in the trade as ICAT fixtures, insulation contact air tight fixtures.

And so there's a test standard for air tightness, and there's also a requirement that they be caulked or gasketed at the ceiling to eliminate that leakage that goes up through. And again, this is only for insulated ceilings.

MR. RAYMER: I guess a question to Bill, to Tom Trimberger, how would a -- I know a building official can eyeball the caulking and sealing, but how would you check for the tightness here?

MR. MAHONE: Well, I can probably answer this. There's a sticker on the fixture saying that it's been rated and passed the test, the ASTM test.

MR. RAYMER: And so --

MR. TRIMBERGER: That was going to be one of my questions, too. So instead of just looking for what is labeled IC, it would be ICAT labeled?

MR. MAHONE: Right.

MR. TRIMBERGER: So we're not doing any testing? We're just grabbing one that's been tested for a leakage rate?

MR. MAHONE: Yeah. The testing is done for the fixture, itself. I guess the only thing that really gets checked in the field is that it's a tested fixture and that it's been sealed. You can't test that at the lab, that's a field installation issue.

Okay, finally, we did a bunch of analysis on the benefit/cost ratios, and I'll just show you two of these. There's more detail in the report.

The first one was just on the basic requirement for high efficacy fixtures as opposed to the more traditional incandescent fixtures. And you probably can't read the table on the screen, but what we have is the benefit/cost ratios for a number of different applications, comparing high efficacy lighting to standard incandescent lighting for kitchens, yards, utility rooms and so forth.

When the value in the table is 1 or greater it means it's cost effective. The benefit is greater than the cost. And we've got three rows here. One is for minimum cost effectiveness based on basically high cost fixtures that we've put into these locations.

Mean based on the mean cost of fixtures that we observed in our surveys. And then max is cost effectiveness when you really get kind of the optimum installation.

So the cost effectiveness for both the mean and the max are way beyond the benefit/cost ratio of 1. And even on the minimum, the benefit/cost ratio tends to be a factor of 2, 3 or 4 for most locations.

So, based on this analysis these requirements that we're proposing meet the benefit/cost requirements. They're good investments for the homeowner.

We also, in the next slide, looked at the benefit/cost for the air tight fixtures, the ICAT fixtures. And this gets to be a more complicated analysis because you're also accounting for the air leakage rates up through these fixtures. And so it's climate dependent, as well as it's not just the lighting energy issue as in the previous analysis.

So, the analysis looked at the leakage rates for these fixtures; it looked at the energy loss rates as a function of the degree days and the climate data for the different climate zones, and calculated the benefit/cost ratio based on the incremental cost of about $4.12 per fixture.

At this point the product is out there and it's not a big cost hit to make sure that it's air tight. In fact, we found some fixtures that were actually cheaper in the ICAT form than in the regular form.

So, in all the climate zones we looked at the benefit/cost ratio was greater than 1. The worst case was San Diego, which is our mildest climate zone, and even there the benefit/cost ratio was 1.7.

MR. RAYMER: Could you go back to the other, the frame right before that?

MR. MAHONE: Yeah. Back up, please.

MR. RAYMER: I need to get the numbers for bedroom.

MR. MAHONE: Oh, for bedroom. I'm sorry. For some reason the slide did not want to include the full table. That table is found in our report on page 9. The minimum value for bedroom is 1.2; the mean is 10.9; and the max is 31.4 for benefit/cost ratio.

The bedroom is the worst case because people tend to sleep in bedrooms rather than spend a lot of waking hours in bedrooms. And we don't have an explicit requirement for bedrooms, other than the tract lighting, recessed lighting, pendant lighting requirement.

And even there, as long as they put the lights on a dimmer for those kinds of fixtures, they can use incandescents for those, as well.

So, that's our basic proposal. I will say that we spent a lot of time going back and forth with the Commission Staff and with a number of lighting industry stakeholders, and NRDC and others who were interested in participating in the conference calls.

A lot of ideas were put forth. A lot of ideas were knocked down. What you have here is what we think is a workable compromise on this. But I will say that there were a number of people involved in this who felt that we could and should go beyond this -- it was our client, actually, PG&E.

I'd like to hand it over to Gary Fernstrom to pick it up from there.

MR. FERNSTROM: Thank you, Doug. I'm Gary Fernstrom from the Pacific Gas and Electric Company.

I was first introduced to compact fluorescent lamps more than a decade ago, in 1989 by Chris Caldwell of the Natural Resources Defense Council. Chris suggested to me that PG&E should be encouraging our customers to utilize this emerging technology, compact fluorescent lamps.

I did some checking and found that, in fact, we had been including the General Electric CircLine product in our low-income programs in the years '86, '87, '88. And I told Chris that. He replied that he felt that was really a very bad idea because we were leaving half the savings on the table. And there was a new product out, the electronically ballasted compact fluorescent lamp that indeed doubled the savings associated with the use of that product; and PG&E ought to be encouraging its customers to use exclusively electronically ballasted compact fluorescent lamps.

So, in the early 1990s we did promote these products. This lamp dates back to 1991. It's a self-ballasted electronic compact fluorescent lamp where the electronic ballast is a decade old. It's ten-year old, or more, technology.

About four years ago I was shopping here in Sacramento at the Home Depot and I found this hardwired fixture brought to me at a special price by the Sacramento Municipal Utility District. Thank you very much, SMUD.

I bought this and brought it home. And my personal opinion, it's a nice looking, surface mount, hardwired fixture with an electronic ballast.

Now, what I can't understand is how, if the electronic ballast can be put in integral products that sell for $5 or $6 at ICEA, why the ballast, itself, that represents 50 percent of the potential energy savings ought not to be cost effective and available to the manufacturers for hardwired fixtures.

It seems to me a no-brainer that those ballasts are available; they are low cost; and there's no reason why in the next three years, by the time these standards come to be effective, that electronic ballasts for fluorescent lamps operating at frequencies above 40 kilohertz ought not to be required.

They're widely available; they're of low incremental cost; and they represent a significant energy savings.

Now, the question might be asked how

would inspectors, in fact, verify that these fixtures had electronic ballasts. And there are small, top-like cardboard devices that one can spin, put on a countertop and tell immediately whether or not the ballast is operating at 60 kilohertz or some high frequency which would indicate that it's electronic.

And I'd suggest that it would be easy for building inspectors to carry along that small cardboard device and check to see whether or not compliance was in effect with that particular requirement.

So, in sum, PG&E believes that the additional energy savings associated with electronic ballasts is significant. They are available. Their cost is low. And any standard the Commission elects to put into effect around these products should require electronic ballasts.

Just one very last comment. I understand from a representative of NEMA that all ballasts made for new fixture use subsequent to 2005 will be electronic ballasts. Now, I'm not sure whether this applies to residential fixtures or not, but magnetic ballasts in general, across the country, are being phased out.

MR. ALCORN: Thank you, Gary. Noah.

MR. HOROWITZ: Noah Horowitz with NRDC. Doug, I want to congratulate you. I was participating in the discussions and you were pulled more ways than any octopus could be. And I think you've come up with a lot of thoughtful compromises here.

Two quick points. On page 8 of your slides, you say up to 50 percent of the watts, if controlled by separate switches, in the exception. Is that the rated wattage of the fixture or of the installed wattage with the bulb that's put in the fixture?

MR. MAHONE: It's the rated wattage of the fixture.

MR. HOROWITZ: Okay, so you might want to clarify that, because there could be a huge difference.

MR. MAHONE: Yeah.

MR. HOROWITZ: Secondly, California new homes especially, there might be one to three ceiling fans installed. And often those have light fixtures attached to those at the time of sale.

How would a ceiling fan, the lights in

those, be characterized? Under which category would they fall? Is that a pendant, or how would -- let's assume it's not in the kitchen or bathroom, which is a safe assumption.

MR. MAHONE: That would be a pendant fixture, that would fall under the requirement for a pendant fixture, which is that it either include high efficacy lamps or the lamps be on a dimmer for that ceiling fan.

MR. HOROWITZ: So if the lights in the fan can be dimmed, they would meet the requirements; or they'd have to be high efficacy?

MR. MAHONE: Exactly.

MR. HOROWITZ: Okay. Thanks.

MR. RAYMER: Since we're looking at requirements that won't be necessarily part of the performance, but will be either required or not, maybe a tradeoff here or there, I want to raise, once again, the same topic that we've had since the early '80s, and that is in dealing with the bathrooms in particular, one of the reasons why it is the way it is now, when you've got a situation where you've got a bedroom designed with the bathroom, and the bathroom sort of split into two for all intents and purposes, you've got the tub or tub/shower combination right next to the lavatory -- sorry, the water closet. And that's enclosed by a door, okay.

Okay, immediately adjacent to that you've got a lavatory that's effectively for cosmetic purposes, you know, putting on makeup and all that.

From a marketing standpoint, it can be assumed that there's going to be incandescent light put there, okay. Whether it's put there at time of construction or immediately after, you're going to see incandescent put there, because the homeowner is simply going to do that.

And we'll be, as with all the proposals we'll be talking about today and have been talking about, we'll be polling a number of our large and medium and small builder members to see how they respond to this. But I know already that I'm going to hear a lot of flack about that part of it, where the only light that could be above that would be fluorescent.

I mean the homeowner is just going to be screaming for incandescent in that one particular area.

MR. HOROWITZ: I'd like to respond to

that. I think you're referring to you've got your bathroom with your shower and toilet, or whatever we're supposed to use. And then you've got one or two sinks with a big mirror and possibly a dressing room behind it.

There is the provision there if they do want to use incandescent they can, provided they put in the occupancy sensor. So you can still have the incandescent if you want, you just have to put the motion control in there.

So I think that's a balance that was struck here.

MR. MAHONE: And the other thing I would point out is we found that there is -- a lot of people are just not aware of the advances in compact fluorescent technology in the last four or five years.

There are a lot of people that just remember the day when they were green and they took forever to turn on, and they flickered. Frankly, there was a lot of damage done by bad product in the earlier days.

The product is much better. The color quality coming out of compact fluorescents is actually superior to the color quality coming out of most low wattage incandescents, which tends to be very yellow and gives a fairly unnatural color to things.

So, I think in polling your members, Bob, I'd urge you to make sure that they know what they're talking about when they say we hate incandescents, because there's a lot of very good product out there now.

MR. ALCORN: You said incandescent, you meant fluorescent?

MR. MAHONE: No, I'm sorry, fluorescents, sorry.

MR. FERNSTROM: I'd also like to mention that the electronic ballasts improve the visual performance of these lamps and eliminate the flicker associated with self-start, magnetically ballasted ones.

MR. ALCORN: Ahmed.

MR. AHMED: Doug, I have a question on your third slide where you define high efficacy lamps.

MR. MAHONE: Yes?

MR. AHMED: Is this only for CFLs, or is it for regular fluorescents with electronic ballasts, as well?

MR. MAHONE: Yeah, this would be for any -- it doesn't actually specify fluorescent technology. These lumens per watt apply to the lamps, no matter whether it's -- you know, if somebody could invent an incandescent lamp that had 40 lumens per watt, that would qualify as high efficacy.

MR. AHMED: But in you --

MR. MAHONE: But as a practical matter, this applies to pin-based, four-foot fluorescents, bi-ax lamps, compact lamps.

MR. AHMED: Okay, yeah, I just wanted to understand that.

MR. MAHONE: It would even apply to small metal halide.

MR. AHMED: And the next question I have was on the recessed luminaires.

MR. MAHONE: On the recessed luminaires?

MR. AHMED: Right. When you say the requirements for ICAT type of fixture, does it include CFLs? And why were they not considered, if they were not?

MR. MAHONE: Well, yeah, it does -- there are ICAT CFL fixtures.

MR. AHMED: Right.

MR. MAHONE: If you take -- this basically is an air leakage program with any kind of recessed fixture, whether it's an incandescent recessed fixture or a fluorescent recessed fixture or metal halide recessed fixture.

The previous requirement that deals with tract recessed and pendant lighting basically says that any recessed light, whether or not it's in an insulated ceiling, should be high efficacy unless it's controlled by a dimmer.

So you can still put incandescent recessed fixtures anywhere in the house as long as you put them on a dimmer. There may be some wattage restrictions because of this 50 percent requirement on their use in kitchens. But there's no similar wattage restriction anywhere else in the house.

So you can take these three slides together, you can pretty much use recessed fixtures anywhere you want to use them, you just need to make sure that they're air tight if it's in an insulated location, and make sure that you don't exceed the wattage limit for non high efficacy fixtures in a kitchen.

MR. ALCORN: Okay. Steve Gates.

MR. GATES: Steve Gates with Hirsch and Associates. Doug, it seems like your analysis concludes that if you go with the height efficacy fixtures in bathrooms or garages that the use of a manual-on occupancy sensor is then not cost effective. Is that the correct conclusion there?

Or, for example, my garage has fluorescent fixtures, so they're high efficacy fixtures, but they're still 320 watts of fixtures out there. My kids are constantly leaving them on. I tried to respond to that by going down to Home Depot and getting a regular occupancy sensor, you know, installed that. And basically the cat is always turning it on now, and every time --

(Laughter.)

MR. GATES: -- every time the breeze blows the tree outside the window it turns on. So, you know, I fully support your conclusion that you need manually-on occupancy sensors, but the question I'm raising is whether just the fact that you have fluorescents in a garage or a laundry room or elsewhere, is that sufficient? Or should there also be occupancy sensors?

It's not unusual for me to walk around my house in the evening and flip off between 1 and

2 kW of lights that the kids have left on everywhere; bathrooms, garage, bedrooms. It seems like this is a huge area that can be addressed.

MR. MAHONE: Well, you're sort of raising a question of how far should we go with this. And we made the judgment that putting in a requirement for manual-on occupancy sensors was okay as an exception.

We weren't quite ready to go all the way to make it a requirement. I think, as you point out, it's probably cost effective in many of these locations, you know, and there's certainly no requirement preventing you from installing them, but we made the judgment not to go as far as you're suggesting.

I'd be willing to hear other people's comments about whether we should do that. Art?

COMMISSIONER ROSENFELD: I just want to say that -- Steve Gates' comment does suggest that there might be some limit. I don't know whether it's 100 watts or 200 watts or something, but at some large power demand in a garage or family room or whatever, I guess kids leave lights on in family rooms an awful lot.

MR. GATES: And in bedrooms even more.

They walk in, they grab something, it's on until --

COMMISSIONER ROSENFELD: Would there be some wattage limit at which it would make sense? I'm thinking of the worst 10 percent of the rooms in the house or something.

MR. MAHONE: Yeah, I think you could certainly cost justify using occupancy sensors in many of the high use locations in a house. As you point out, it would be a function of the wattage that's attached to it.

Places like garages and perhaps laundry rooms may have enough wattage on one circuit that it could make sense. Certainly from an economic point of view would make sense to have that kind of control in there.

Other rooms of the house, it gets to be a little more problematic, because the circuiting is kind of all over the map, you know, and you end up having to rewire the room in order to bring all the wattage to the location where the occupancy sensor is set up.

There's a little concern that some fluorescent technologies are kind of unhappy being switched on and off too often, although I think that's going away.

So, I don't know, I guess it sounds like you're supporting Steve's notion that we look into requiring these kinds of controls?

COMMISSIONER ROSENFELD: Yeah.

MR. GATES: Just one final comment on that. The daylight, or I should say the occupancy sensor I installed in my garage explicitly said not for use with electronic ballasts. And so I don't know if that's an area that needs to be addressed.

This was like a $15 occupancy sensor. And actually with the fluorescent lights in there, it does cause them to flicker in a way that they didn't flicker before. So, it's -- I don't know what kind of interactions there are between occupancy sensors and high efficacy lighting. But that should be something that needs to be looked into as part of this.

MR. MAHONE: Yeah.

MR. FERNSTROM: Some of the occupancy sensors use -- or solid state relay control, and they're not designed for the high end rush current necessarily associated with electronic ballasts. Others use relays, and they're rated for any type of fixture.

MR. ALCORN: Noah.

MR. HOROWITZ: Just a quick comment, as we've added the potential exception to allow the sensors maybe some information gathering in terms of cost on some of these issues, so if they're myths or reality we would know early in the proceeding. If it is a problem then parts of the language would have to be changed.

I don't anticipate that problem would be good to hand out the information later.

MR. HUNT: We actually have within our reports table 5; we did some cost effectiveness analysis. This is on page 9 on occupancy sensor or motion sensor upgrades for different locations in the house.

It's not as clear of a slam dunk in terms of cost effectiveness for all locations, except for yard lighting where it's a big winner, because yard lighting tends to stay on all night.

Living areas, the benefit/cost ratio has a mean of 6.2. Bathrooms it has a mean of 1.8. Utility/garage, it's a little bit marginal, but it's highly sensitive to what you assume for hours of operation, because it's clearly a behavioral thing.

MR. HOROWITZ: Doug, what I was getting at, just to summarize, if it's not too much, are these $2, $5, $10, 50, are they compatible with electronic ballasts or not. That would be good information to have. We don't need it today, but --

MR. MAHONE: Okay.

MR. FERNSTROM: And it makes a big difference whether you have a cat in the garage or not.

MR. MAHONE: Okay, if somebody could suggest some language for the standards on the cat control issue, we'd appreciate that, as well.

COMMISSIONER ROSENFELD: Hold on. Now I'm confused because I thought you said that the manual will solve the cat problem.

MR. MAHONE: Yeah, it would solve the cat problem.

MR. FERNSTROM: Unless you have a smart cat.

(Laughter.)

MR. MAHONE: Yeah, the way the manual on-fixtures work is you walk in the room, nothing happens. You got to hit the switch, just like you do -- although it's usually a button. And then after motion ceases there's a time delay. And then it goes off, again. And the smart ones, actually when it goes off again, if you wave your hands it comes on again if you do it within the first 30 seconds or so, so that, you know, if you installed one of these in a bathroom and you're in the tub and you're reading your novel and the light goes off, you don't have to hop out and hit the damn switch again. You know, you can wave your hand and it will come back and say, oops, sorry.

MR. ELEY: -- actually apologizes --

MR. MAHONE: Well, I'm not sure if that feature's built in, but it would be a nice feature.

(Laughter.)

MR. SPEAKER: That's only the Japanese model.

MR. MAHONE: It's the really high-end controls, oh, so sorry, sir.

MR. PENNINGTON: Just as a statement from staff, I'd like to congratulate the team that put this together in terms of the level of effort that they went to try to elicit comments from, you know, all the likely proponents for this kind of a change.

And it includes experts in the lighting field, including Jim Benya and Michael Seminivich, that commented. There was some attempt to get input from building officials. The staff had countless obnoxious comments --

(Laughter.)

MR. PENNINGTON: -- to make.

MR. MAHONE: Yeah, we had countless obnoxious replies.

MR. PENNINGTON: And those were responded to. We think that this proposal is a really good proposal that will improve the situation we currently have. And is a balanced proposal. I think it could, in some ways, be more aggressive, maybe. But I really question whether that's appropriate for a round of standards.

So, anyway, it's a good job.

MR. ALCORN: Tom Trimberger.

MR. FERNSTROM: What is the staff's disposition on electronic ballasts.

MR. PENNINGTON: Well, maybe I need some help from Mazi. I'm not sure what the range of the federal appliance standard is, either, whether it affects all of this equipment. I suspect it doesn't affect all of it.

But the portion that it does affect a requirement would be moot from the Energy Commission because it would be basically preempted by a standard that would go into effect at the same time as this standard would go into effect.

I think that Jim Benya, in particular, has some concerns about ruling out what he views to be satisfactory ballast technologies with a sort of broadbrush requirement.

MR. FERNSTROM: Magnetic ballasts --

MR. PENNINGTON: I'm not sure he's talking about magnetic; I wish he was here. Maybe, Mazi, you can represent that comment, I don't know?

MR. SHIRAKH: Again, it was mostly Jim Benya's concern. He was concerned about certain type of pin-based PL type of fixtures that use magnetics, and they perform well. And he thought the efficiencies were quite satisfactory.

Having said that, you know, we can -- we had a lot of debate, you know, we put it in there; we took it back out; put it in there. And finally, you know, we had to make a decision and we decided because there was so much controversy, not to put it in. We could pose the question again to him and have him respond to it.

One note on the 2005 federal standards, I don't think it applies to compact fluorescents. We looked at the language and it's strictly for linear type F40 four-foot lamps.

MR. FERNSTROM: So while the EnergyStar specification doesn't apply to hardwired fixtures, it does mandate electronic ballasts for all integral products. And the Pacific Gas and Electric Company, anyway, would be very pleased if the staff would revisit this question because PG&E believes it's unconscionable to leave half the energy savings on the table.

MR. ALCORN: Thank you. I'd like to recognize Tom Trimberger.

MR. TRIMBERGER: Hi, Tom Trimberger from CALBO. Couple of questions. It talks about regulating track and pendant lights. Is it specifically saying if you have a surface-mounted light it's not regulated, then?

MR. MAHONE: Yeah, surface-mounted fixtures don't fall under this.

MR. TRIMBERGER: Is that just because

they're easy to replace, or why is that?

MR. MAHONE: Well, there's a lot more variety in surface fixtures. We're specifically focused on tracks and recessed lighting, because there's a lot of, I think, excess incandescent use in those.

The pendant fixtures are discrete enough that we felt we could include those in the proposal. There's so much variety in the surface-mounted fixtures that we basically just decided not to go there for this round.

MR. TRIMBERGER: For the last couple of slides, talk about the benefit/cost for ICAT fixtures and for high efficiency, is this looking at, you know, talk about benefit/cost ratio, is the benefit/cost of 1, does that mean that it pays for itself in 30 years?

MR. MAHONE: Yes.

MR. TRIMBERGER: So, --

MR. MAHONE: It's cost effective using the economic criteria that the Commission has adopted for standards. In other words, the value of the energy savings on a life cycle basis equals or exceeds the cost of installing the measure.

MR. TRIMBERGER: Okay, so that is worked

into there, that they're looking at the time value of -- is already included in there. Okay, thank you.

On page 3, looking at defining high efficacy luminaires as being greater than 40, 50 or 60. What does that look like in the real world? Does that mean just any fluorescent works?

MR. MAHONE: Yeah, it means pin-based fluorescents in the real world.

MR. TRIMBERGER: And pin-based --

MR. MAHONE: As opposed to screw-in. Well, actually the screw-in part is handled by the third bullet there. You could have screw-in compact fluorescents that met these lumens per watt requirements, but they're not allowed because they're screw-in and they can be unscrewed and replaced with a light bulb.

MR. TRIMBERGER: Is that the disadvantage of the screw-in, is they can be replaced by an incandescent easily?

MR. MAHONE: Yeah . There's a lot of anecdotal evidence that they walk away and get replaced with 60-cent light bulbs, incandescent light bulbs.

MR. TRIMBERGER: Is that what the line

voltage -- med-based socket says?
MR. MAHONE: Yeah. Med base means medium-based socket. Says regular screw-in light bulb sockets. And the line voltage there is a technical thing, because there are some -- we're not trying to regulate the low-voltage lamps.
Or also, there are some high efficacy ballasted kinds of things where the voltage coming into the socket is not at line voltage because it's operated through a ballast. It gets kind of technical. I'm probably not the right guy to answer that.
MR. TRIMBERGER: Okay. One other thing. Gary, you talked about a little card that would test the frequency that it's operating on. If I'm just looking for a pin-based fluorescents, why do I need the card?
MR. FERNSTROM: That card differentiates between magnetically ballasted fluorescent and electronically ballasted ones.
MR. TRIMBERGER: But are either one acceptable?
MR. MAHONE: Under the current proposal either one's acceptable. Gary is proposing that we eliminate allowing magnetically ballasted

lamps. And you could use this little spinner to distinguish between the magnetically and electronically ballasted lamps.

MR. TRIMBERGER: Thank you.

MR. EHRLICH: Charles Ehrlich with HMG. There is one comment I wanted to make about -- there was a comment made about the EnergyStar requirements. There actually are two sets of standards. One is for the screw-in type self-ballasted lamps, and the second one is for the hardware fixtures.

And we consulted with that standard in developing our recommendations, and there's sort of a line item little disclaimer in there, which says that DOE and EnergyStar folks reserve the right to, in the future, not allow magnetic ballasts.

So there's lots of thought going into this. And while we can't refer to EnergyStar as a standard, there's a lot of movement in the direction of electronic ballasts, both for hardwired as well as screw-in types.

Thank you.

MR. ALCORN: Are there any more questions or comments on this measure report? In that event, thank you very much, Doug, and --

MR. MAHONE: Thank you.

MR. ALCORN: -- others, for comments. And we'll move to the second topic, which is residential fenestration. And Bruce Wilcox will make that presentation.

MR. WILCOX: Thank you, Bryan. This work on this topic was done primarily by Ken Nittler of Enercomp and by me, along with the Commission Staff.

And so let's go to the first slide. What we're proposing here, in summary, is three things. We're proposing to increase the prescriptive glazing limit to 20 percent of the conditioned floor area in all climate zones.

This is a change in the -- some of the climate zones now have smaller areas, so this changes, the proposed change is to do it, all climate zones to 20 percent.

Second thing is to change the rules for the performance compliance option so that you don't get credit for smaller glazing areas anymore.

And the third proposal is to put a new prescriptive limit on west-facing glass so that if you're going to use prescriptive package compliance you can't have more than 5 percent of the conditioned floor area in west-facing glass.

So that's the three elements of this proposal. Now, I'm going to talk about each one of those in detail.

In terms of the prescriptive glazing limit, what this is is the total area of glazing allowed in the prescriptive packages without having to do any performance tradeoffs. You can simply build the prescriptive package, and as long as you have glazing that's less than or equal to this prescriptive glazing limit.

Currently that limit is 16 percent of the conditioned floor area in nine out of the 16 climate zones, 1, 2, 5, 11, 12, 13, 14, 15 and 16. Those are basically the zones that have either hotter summers or colder winters or a combination of the two.

Twenty percent of the conditioned floor area is allowed in climate zones 3, 4, 6, 7, 8, 9 and 10, which are the coastal milder climate areas of northern and southern California.

We propose to change that situation so that the prescriptive limit is 20 percent of the conditioned floor area in all 16 climate zones.

Next slide. All right, the prescriptive glazing limit also sets the standard design performance target under the current performance compliance approach. The way the performance -- and the performance approach, of course, is very important in California because somewhere between 80 and 90 percent of all the building permit applications are using performance approach. So it's basically the fundamental approach to the standard.

The current rules are that the standard design always has the glazing area equal to the prescriptive glazing area, the prescriptive glazing limit. So when you do your MICROPAS or your CALRES runs, the energy budget that you're comparing yourself to, under the current rules, if you're in climate zone 12, has 16 percent of the floor area in glass, equally distributed.

If you're in climate zone 10, it has 20 percent of the floor area in glass equally distributed. Regardless of what glazing area you're proposing.

And the implication of that is that if you propose, you know, a house with 15 percent of the floor area in glass in climate zone 10, you get to actually take credit for energy savings due to the lower heat gain and lower heat loss compared to the 20 percent that's in the standard design budget.

What we're proposing is to remove that glazing area tradeoff for houses that have smaller glazing areas than the prescriptive glazing limit. So the proposal here is that the standard design house would have a glazing area equal to the proposed glazing area, unless you were proposing more than the 20 percent limit, in which case it would have 20 percent.

So, what this does is your 15 percent house, 15 percent glazing house would now be compared to a standard design with 15 percent glazing equally distributed. And it would have a tighter budget than under the current rules.

Okay, next slide. The west glass limit is a new prescriptive package requirement compared to the current standards. There isn't any limit by orientation under the current packages.

And what the proposal is is that west-facing glass, if you're doing package compliance, would be limited to 5 percent or less of the conditioned floor area.

Now, just to make it clear what we're talking about there, if you had a 2000 square foot house, 5 percent of the conditioned floor area would be 100 square feet, and so you could propose any glazing area that you wanted to and you would meet this requirement if the west-facing glass was 100 square feet or less.

MR. MATTINSON: And the total didn't exceed 20 percent.

MR. WILCOX: And the total didn't exceed 20 percent, right.

COMMISSIONER ROSENFELD: Bruce, I'm confused, though, when we get into southwest or northwest, whatever. Can you --

SPEAKER: Forty-five on each side.

MR. ELEY: Yeah, the current rules say if you're within 45 degrees of west, then it's west.

COMMISSIONER ROSENFELD: Okay.

MR. WILCOX: There were some advocates for expanding west to include close to 180 degrees, but so far we're limiting it to 90 degrees in our proposal.

Any other questions on that?

Okay, the reason for the limit on west-facing glass is because of its impact on cooling equipment sizing, which we all think is critical to cost effectiveness and peak electrical demand. It's also west-facing glass puts the cooling load on peak and it's very critical to the attempts to use the building standards to reduce peak demand from residential buildings.

And also, I think it has impacts for comfort; large, west-glass areas tend to be really a comfort problem in the cooling season. So those are the reasons for putting this requirement in.

Next slide. We've done some analysis to compare the energy impact of using 50 percent west glass orientation compared to the same house with equally distributed glass. And the numbers speak for themselves. They're significant.

The energy increases, particularly in the cooling dominated climate zones. And so that's why we made the proposal to limit the west glass in those cooling dominated climate zones. We were going to try and come up with a percentage number here, but we didn't actually do it, off the top of our heads here.

MR. RAYMER: So you're proposing a

maximum with the prescriptive would be 25 percent of your total glass?

MR. WILCOX: No. There's a -- the proposal is two limits at 20 percent of the total -- 20 percent total of the floor area. And a second limit that's 5 percent.

MR. RAYMER: Five percent of that 20, okay.

MR. WILCOX: So, --

SPEAKER: No, 5 percent of the floor area.

MR. RAYMER: Right.

MR. WILCOX: So the 5 percent, you can have 100 square feet of glass facing west in my 2000 square foot example, regardless of whether you were proposing to have 400 square feet of total glass or 300 square feet of total glass, or, you know, doesn't depend on what the total glass percentage is. It's a fixed limit on the west glass. It only depends on the floor area.

MR. RAYMER: And if the builder wanted to go beyond that 5, he would have to do performance?

MR. WILCOX: Right.

COMMISSIONER ROSENFELD: Bruce, I'm

still totally confused about what this 50 percent means on your table.

MR. WILCOX: This is an alternative, this is what would happen if we didn't have the 5, the limit, the 5 percent west limit. It's fairly common for production houses to have 50 percent of their glass on one side. At least in some kinds of designs.

So, if that was -- if we didn't have the 5 percent west limit, then we could expect that some fraction of the houses would end up with 50 percent of their glass on the west side.

And this is the added energy use for those houses.

COMMISSIONER ROSENFELD: So, specifically if the total glass were 20 percent, this would mean 10 percent of the floor area facing west, that's what this table assumes?

MR. WILCOX: Right.

MR. RAYMER: That's what I was trying to say the last time.

MR. WILCOX: Yeah, I know, well, it's complicated. And we decided, we specifically decided to make that 5 percent not a function of the glass area because --

MR. RAYMER: But base it on something.
MR. WILCOX: Yeah. Well, if you make it a function of the glass area then if somebody wants to have a lot of glass facing west, they're encouraged to put more windows on the east side, make it all work out, which is not exactly the right conclusion.
(Laughter.)
MR. WILCOX: It's those fan of windows that you claim in your compliance and they never install, you know, that problem.
MR. ALCORN: Can we get through the presentation and then we'll have the questions. Thank you.
MR. WILCOX: Okay, next slide. All right, the benefits of this proposal. The fundamental benefit here is I personally am fairly strongly convinced that this will result in more cost effective energy and demand savings in new California houses.
I'm going to show you in a few minutes, based on our analysis, this will reduce the total energy and demand on a statewide basis we think. And it will result in more homes having close to the cost effective package features.

And this is particularly going to be important and a big change in multifamily buildings, where currently because typical multifamily buildings have glazing percentage of floor areas that are down 12, 13, 11 percent on the floor area, that studies done by Heschong Mahone Group and PG&E and various people have shown that you basically never need to do any conservation measures in multifamily housing, and particularly in southern California. And it's because of primarily the glazing area tradeoff.

So, taking out the glazing area tradeoff will encourage houses that have small glazing areas and multifamily buildings with small glazing areas to put in the measures that we have shown are cost effective, which can save energy for the buyers and occupants of those buildings.

Another way of looking at this is if you think about high performance windows as a measure, we can show that those are cost effective as ways to save cooling and ways to save heating in California climates.

And if you take a window and you do the analysis on that window, you can show that it's cost effective to put in the high performance, low solar gain, low E glass, and that's a cost effective thing to do.

Well, that conclusion doesn't depend on how many of those windows you have. If you have one of those windows in your house it's cost effective to do it. If you have 20 of those windows it's cost effective to do it.

And the current standards approach really says that you only have to do that cost effective glazing if you have a lot of windows. If you have a few windows it's okay to put in single glass. And that's the change here, is that I think we'll end up with more people putting in the cost effective measures that will save energy for everybody.

Another benefit of this approach is that prescriptive packages could potentially become more useful in the compliance world. And there's been a lot of talk for a long time about making prescriptive packages that are actually buildable and useful for builders.

One of the major problems with the prescriptive packages in the past has been the glazing area limits that were smaller than what people wanted to be using, particularly in the central valley climates where the 16 percent limit is routinely exceeded by average houses, production houses.

So this, I think, will tend to make those prescriptive packages more useful. And hopefully everyone will benefit from that.

Next slide. Okay, so now I want to talk about the analysis of what this impact of this measure will be. And one of the fundamental issues there is what is the glazing area in California new homes.

And what I'm going to talk about here is glazing area distribution. And what that is, it's the frequency of buildings with a particular glazing area. How many buildings have -- how many homes have 12 percent glass, 15 percent glass, 18 percent glass, 25 percent glass and so forth.

We've been using a new study that was produced by RER, Regional Economic Research, for the California utilities, CALMAC Group, which was designed to represent typical residential construction in 1998 and 1999. There's 752 residential units in this distributed across the state.

So we're using this study as a basis for looking at what the real distribution of glazing area is under the current rules in new houses.

The results here are similar to the study that I did for the CEC in 1992 on houses built in that era. And the results aren't exactly the same, but their characteristics are basically very similar.

Next slide.

MR. ALCORN: Bruce, may I interrupt you just a moment?

MR. WILCOX: Sure.

MR. ALCORN: -- at the end of your -- past the time for your presentation, so if there's any way you can accelerate it that would be useful.

MR. WILCOX: Okay. So this bar graph shows the distribution of glazing. And the height of the bars indicates the number of houses in this sample of 752, and each one of the glazing percentages shown across the bottom.

The most houses are at 16 percent glass. But there's a significant number of houses that re down at low glass areas, and a few houses that are at much higher glass areas.

MR. ELEY: This is multifamily and

single?

MR. WILCOX: This is multifamily and single family, so this is supposed to represent the population of new homes, multi and single family.

Next slide. Of note here, 15 percent have a glazing area higher than 20 percent; 45 percent have glazing areas less than 16 percent.

Next slide. So here's the way the tradeoffs work. I'm not going to go into the details here, but if you look at this, the heavy dark line across -- goes straight across, is the current approach to performance calculations, which says that the budget is the same regardless of what the glazing area in the proposed house is.

And this is for climate zone 13. The new proposal is the purple line here which says that once you're below 20 percent, the budget depends on the glazing area in your proposed house. All the houses down below this in this area down here we're saving energy. And the houses in this area up here, the energy use is allowed to increase because we've raised it from 16 to 20 percent in climate zone 13.

Above 20 percent, then the line goes

flat in both cases. So the issue is how big is this area versus this area for the statewide houses.

Next slide. We looked at that by taking the standard approach we've been using for all these measures, the 1761 prototype, using MICROPAS. And we assumed that the glazing distribution statewide applied to each of the 16 climate zones when we did the analysis. We then weighted each climate zone by relative housing starts, and averaged for the state.

Next slide. Okay, here's the sort of meat of the whole thing. There's two groups of bars here. On the left, the left group of bars were done with source energy; the right group of bars were done with TDV energy. The conclusions are the same basically.

Under the current system the statewide average is 34.7 kBtus/square foot source energy. And if you just change to our proposed new system and assume that the builders don't respond by changing the glass area in all the buildings to make it bigger -- why would they ever do that? -- then we save about 5 percent on a statewide basis.

And that's true either on TDV or source

energy. And, in fact, if you look at what happens if people do, in fact, increase the glazing area, there's no saving energy even if every house raised the glazing percentage 3 percent of the floor area, or 20 percent of the total area.

MR. STONE: Bruce, can I ask you a quick question?

MR. WILCOX: No. Next slide.

MR. STONE: It's a quick question.

(Laughter.)

MR. ALCORN: Maybe we can come back to the hard copy. We need to get through this presentation, Nehemiah.

MR. STONE: I just want to know what the energy is on here. Is this cooling, is this heating, is this total, does it include --

MR. WILCOX: Total.

MR. STONE: -- water heating? What is the energy?

MR. WILCOX: Well, water heating doesn't vary, so it doesn't matter.

So why is that an issue?

MR. STONE: What is the energy? It's everything. It is everything.

MR. WILCOX: Glad we got that clarified.

Next slide, please.

All right, so the conclusion. This proposal saves energy, 5 percent, on a statewide basis if glazing doesn't change. It even saves energy if glazing area goes up, more than you would expect it to do if you look at it.

I think it improves the prescriptive packages, makes everything more cost effective and so we recommend doing it. Thank you.

MR. ALCORN: Thank you, Bruce.

Nehemiah?

MR. STONE: Now I have a bunch of questions, none of which are short. The first one, if you go back to the slide that shows the energy impact of 50 percent glazing in the west, you see that there is no energy impact in climate zone 1, and there's almost none in climate zone 5.

So would your proposal exempt --

MR. WILCOX: Yes.

MR. STONE: -- 1 and 5 from that prescriptive requirement?

MR. WILCOX: Yeah. Actually what I said was probably ambiguous. We're proposing this only for the climate zones that are identified as cooling climate zones where we're requiring low solar glass.

MR. STONE: Second question. You mentioned multifamily a number of times, but it looked like the analysis was all done with 1761 single family. Did you take a look at the cost effectiveness with multifamily?

And I have a specific question about that related to the west-facing. A lot of multifamily units, when they're built, the units, themselves, only have one orientation that you can put any glass on.

So, for a lot of the units in a building, west is all they're going to get. They don't have any other choice but west-faced glazing. And the building, itself, may only have two orientations that it can have glass on. In some cases that's going to be west and east.

So, is this proposal to apply to all of those multifamily occupancies? And if so, is that cost effective, is it do-able, even?

MR. WILCOX: We didn't -- make it clear, we didn't do any cost effectiveness analysis here, because what we're proposing doesn't cost anything, as far as I know.

And the question of what to do on a

multifamily, this is intended to apply to multifamily buildings, as well. If you wanted to have more than 5 percent of the floor area facing west, you would have to do a performance analysis just like you do now. I don't think it's --

SPEAKER: This isn't a mandatory package; this is an option.

MR. STONE: Prescriptive package, I understand that. So you'd have to go to the performance --

MR. WILCOX: Right.

MR. STONE: The last question, when this topic first came up, one of the things that's put on the table was to move from a fenestration percentage as a basis of CFA to window/wall ratio.

And my understanding at that time was that you were going to take a look at that option and examine whether that was preferable and what the impact would be of going to that option. Did you do that?

MR. WILCOX: Well, we talked about that option but we decided that that was a pretty major change in the approach to the standards. We all know how to do it the other way. And didn't see any overwhelming arguments for doing it that way rather than what we proposed here.

Because I think what we proposed here solves the problem largely. So the answer is no, we didn't analyze that.

I really fundamentally don't see the answer's going to be very different. And I think if we were to do percentage of wall area in multifamily and not single family then you've got all the definitional problems of what to do, which is one and which is the other.

And all of that stuff, and all the, you know, encouraging people to put in higher ceilings in multifamily and all that stuff. And I think that unless there's some reason why this approach really fails, then it's not worth doing.

MR. STONE: Well, it's tied up with the questions I asked earlier, and that essentially with multifamily you're going to have one or typically at most two exterior walls.

MR. WILCOX: I don't understand why that's a problem.

MR. STONE: It's not a problem, Bruce, but currently that's how you deal with the fenestration area for high rise residential. It is a window/wall ratio. So we're not changing anything for that portion of multifamily, I mean we wouldn't be.

And the problem of where your view is and how much glass you can have, the west-facing issue, in other words, goes away if it's simply a window/wall ratio.

MR. WILCOX: Well, see, we're proposing to let a multifamily building have 20 percent of the floor area for the total building, right?

MR. STONE: But they're typically only 8 to 10 percent anyway.

MR. WILCOX: That's right, so what we're proposing here isn't going to be a problem for someone complying in a multifamily building. What we are proposing to do is change the rules so they have to put in conservation measures when they put in 10 percent glass. And I think that solves -- that's solving the problem that you raised in the current standards, which I think is definitely a problem.

MR. PENNINGTON: Just a short reaction. In the scenarios that you were describing there, Nehemiah, it sounds like to me that 50 percent of multifamily buildings could use the prescriptive approach because they've got all their glass oriented other than east/west.

That would be far higher percentage, I think, than single family buildings that could use the package with the 5 percent west requirement. So it sounds like really good news.

MR. STONE: That's -- you're right.

(Laughter.)

MR. ALCORN: Recognize Bill Mattinson.

MR. MATTINSON: I have a few comments on this. And I want to say that in one regard I really appreciate the work that's been done here, and that is the restriction to the 5 percent glazing on west glass and prescriptive packages.

It's been my contention, contrary to what a lot of other people seem to believe, that the packages are actually far less stringent on performance, and have been forever because of that very point that you can have unlimited west glass in a prescriptive package. And certainly in the cooling climate zones, that increases energy use, and certainly increases peak in a major way. So I think this is a great improvement.

I do have problems with the other two points for several reasons, that being the increase from 16 to 20 percent in all climate zones for allowed glazing; and the second point where the standard glazing area is fixed equal to the proposed.

And I'm just going to refer to a few of the points in the paper. Maybe I'll just go through my whole discussion and then if Bruce or anyone wants to respond, we can do that.

On page 4 of the paper it says it simplifies the compliance procedure. I don't see how it does. There's still going to be documentation submitted; there's still going to be plan check; there's still going to be field inspection.

But, in fact, I think the plan check and the field inspection may be more difficult because the prescriptive compliance documents are less comprehensive than what you normally get from a performance analysis. And I tend to think that they will be performed by people who are less skilled and less experienced, making it perhaps more difficult to verify the proposed measures and to inspect them in the field.

So, I don't see that that really simplifies things. I mean I guess it's simpler to have one number instead of two, but for the rest of it I don't see any real simplification.

And then also it says on page 4 that only homes at or above the prescriptive glazing limit are required to install the full set of cost effective measures, implying that if you're using less than the maximum your 16 or 20 percent in the relevant climate zones, that you don't have to install the other prescriptive measures.

And I don't find that to be true unless the proposed house has equal glazing distribution just like in the prescriptive packages. If you have equal and you're at 14 percent, then maybe you can reduce some of the measures, or eliminate a measure or two.

But if you're at 50 percent west glass, or 40 percent or 30 percent or some combination of south and west that's the predominant total of the glazing area, that house, even at below the 16 or 20 percent prescriptive maximum, is going to require more measures to achieve compliance than the standard house. So, I don't think that that is really true, either.

And then it says on page 4 again there will be fewer cases where performance must be used, implying that doing more prescriptive is better, simpler, nicer in some way. I don't really know if that's going to be true. Certainly not for production homes where -- and we do a lot of compliance calculations for production homes, as well as customer homes.

But almost every production home I can recall ever seeing has more than 5 percent glass on at least one orientation, usually the real orientation that faces to the yard. Or also the front orientation that faces the street, and gives it its sales appeal.

In a production home every builder -- every production builder that I'm aware of does a multi-orientation compliance method where they want to build all of plan A the same; in fact, they want to build all the plans the same.

So they do the cardinal orientation calculation and build to the worst case orientation. If they've got more than 5 percent on any orientation, then they're not going to be in the prescriptive package. So I don't even see that that's going to occur in the production arena, which is the vast majority. I'm not saying all the homes built, but that's a lot of them.

And then finally on page 4 it says the

installed, or the total cost to comply will be reduced. I don't see how if you, as a builder or a designer, or a homeowner having a home built, choose to reduce the glass area as a conservation measure, and then you are required to put in all the measures that you would have been required to put in had you had more glass area, I don't see how that's going to cost less to comply. It's going to cost the same to comply.

And, getting away from the details of the report, and just back to basic principles, this is something I mentioned back in November at our sort of scoping meetings when this came up, but as an energy consultant, for 25 years I've been working with architects, builders, developers, homeowners. And before the standards came into play, working with people to make more efficient and comfortable buildings.

Every one of my clients has understood a couple of simple facts. One is increasing glass area increases energy use. Other than the rare case of the perfectly designed passive solar, which I'll set aside for the moment.

More glass area means more energy use. Reducing glass area saves energy. No one's ever denied that. It's pretty much well understood and it's the kind of advice that clients need to hear.

The way that works now under the current standards where the proposed glass area is what it is and the standard glass area is fixed at the prescriptive maximum, when you do a MICROPAS, ENERGYPRO or CALRES run and show your client that his proposed design -- and the vast majority of proposed designs that come into our office don't comply on the first pass. We work with the builder, the developer to find a cost effective solution for them.

And when you show them that it doesn't comply, here's the standard budget, here's your proposed budget. And then if you re-run it, saying we could take out a couple windows or reduce them, you'll see that the budgets, the proposed budget moves down perhaps to within the allowed limit.

Under this scenario both budgets are going to move, and the builder's not going to get a message at all that reducing glass area means a thing. And that is just plain contrary to common sense and to the kind of advice that I think many of us have been giving clients for a long, long time.

So, the message that these two proposals give is more glass area is fine; go to 20 percent; that's okay. I don't quite understand why. And if you choose to reduce glass area to save energy, that doesn't help you out, either. So, I'm a little confused about that.

Now, I know there's some justification based on the overall, and I'll get to that in a moment.

I just want to point out that figure 1 that shows the distribution of the glazing percentages, as Charles pointed out, is including multifamily and single family. Well, if you look at everything on the left side of the chart, below about 11 percent, and then go to the RER study, that was all in multifamily. The single family homes, there's very very few. In fact, I question how homes get much below 10 percent, because I thought they were lighting ventilation requirements that are imposing that as a minimum. But that's another piece of territory we don't need to go into.

So, I'm merely pointing out that the low glazing percentage areas were in multifamily for the most part.

Since the data in that distribution seemed to be that the basis for the proposed savings to be achieved by setting the standard glazing area equal to the proposed area, it seems like the energy consumption and increasing the 16 percent climates to 20 is supposed to be offset.

The single family increase in energy is supposed to be offset by the savings in multifamily.

And I know that Warren Alquist allows the standards to be cost effective, as a whole, and every individual component doesn't all have to pencil out. But it seems silly to me to impose the same rules on single family and multifamily buildings when the result is so contradictory to common sense.

Back in November CABEC responded to these same issues by suggesting that the allowed glazing area should vary between single family and multifamily homes. It's apparent that multifamily homes typically have less glazing area, mainly because they have less exposed wall area. Why not simply reduce the allowed glazing area by a fixed percentage for each exterior wall that has no solar exposure?

In other words, if you're allowed 16 percent for a single family home, but you've got a multifamily home that only has three walls exposed, reduce the allowed glass area by some number, 2 percent per wall, is that your worst case where you've got only two walls exposed, you're now down to 12 percent.

I don't want to step on the required minimums for light, ventilation, egress or anything like that, so I'm not proposing an aggressive stepped percentage that's totally equivalent. But I think that makes a lot of sense.

We're trying to fix a problem with multifamily getting away with things by mixing it all up between single and multifamily, and it just doesn't make sense to me.

We already have different standards, as Nehemiah pointed out, for high rise residential buildings. Under this current proceeding we're considering special standards, special rules for multifamily water heating. And the reason we're doing it is to reflect the way that multifamily homes are actually built. When we get to this topic I think the main point is that the multifamily homes are not built with single individual water heaters. And anybody who puts in the real water heater gets a big savings, because it's a central unit.

I'm suggesting that the same parallel be drawn here that multifamily homes are built differently. And to try and squash them into the same rules as single family just is plain silly. Let's recognize them for what they are.

And then finally if you want to lump, you know, single and multifamily together and you want to encourage prescriptive compliance and reduce tradeoffs, none of which I'm sure are really going to happen, and you propose to do this by encouraging builders to increase the glass area here and discourage them from reducing it there, I just think we're ending up in a mess, you know. It doesn't make sense.

That's the end of my points.

MR. ALCORN: Thank you, Bill. Bruce, did you want to respond?

MR. WILCOX: Well, we're not making a change here to treat multifamily and single family the same. They've been treated the same for 25 years.

And what we're trying to do is make the treatment of glazing area and conservation measure cost effectiveness rational. And I think the part that says that it's fine to put in single glass and electric resistance heat in multifamily buildings as has been done for 25 years is the part that's irrational.

MR. MATTINSON: See, I'm not proposing that, either, Bruce. I mean I said --

MR. WILCOX: Well, you've been doing it for 25 years and you didn't have a problem with it last year.

MR. MATTINSON: Yes, I did. It's on the record.

MR. WILCOX: Well, okay, so, we're not proposing to mess up things to deal with that. I think the issue about --

MR. MATTINSON: No, you're proposing to continue to mess up things by mixing these two different kinds of housing stock together. And I think that the --

MR. WILCOX: The truth is, Bill, -- I'm sorry, can I make my statement now?

MR. MATTINSON: I'm sorry.

MR. WILCOX: All right, the truth is that what I said about windows is absolutely true. The same window is cost effective regardless of how many windows you have.

MR. MATTINSON: But the most cost effective --

MR. WILCOX: That's the physics.

MR. MATTINSON: -- window is the one you don't put in, because it doesn't cost you anything.

MR. WILCOX: You always have the option of doing that, Bill. You always have the option of doing that. But the truth is that --

MR. MATTINSON: You just don't get anything out of it under your proposal.

MR. WILCOX: Well, you know, there's affirmative evidence that in fact changing the rules the way we're proposing here, in fact, may not change the glazing area. The State of Oregon has had this kind of set of rules now for the last five years or so; and the State of Washington has had, you know, same climate, same kind of buildings, same builders, has had the other kind of rules where the glazing area was limited. And the glazing areas are not different between those two states. I think --

MR. RAYMER: I don't see this increasing window area because --

MR. WILCOX: I think that when you start talking about people putting in good, high performance, cost effective windows, they're expensive and people are going to not put them in. We're not talking Texas here where the windows are cheaper than the walls.

(Laughter.)

MR. WILCOX: Which is the real case in Texas. We're talking about putting in stuff that really works. And that's the whole point here, is to get people to put in the cost effective, high efficiency measures.

MR. MATTINSON: And let them put in more windows in all those climate zones. How does that save energy? I just don't get that.

MR. ELEY: I wanted to make just a couple of brief comments that I think respond to your questions, Bill.

One thing is that I think this proposal deals in a very equitable way with the multifamily issue. Also, you know, we went to an approach like this for nonresidential buildings in '92, and

I think it was very successful. It recognizes that window area is really an amenity. In many ways, having a limit on window area is like having a limit on floor area.

I mean you could make the same argument, Bill, that if your clients took 100 square feet of floor area out of their building they would save energy.

MR. MATTINSON: I could make the argument that the speed limit is irrelevant, too, you know.

MR. ELEY: And windows are really an amenity. It's like saying, well, you should have fewer bathrooms, so you use less water. Less floor area. So, I kind of want to make that case.

The other thing is this -- we have this legacy of 16 percent windows in some climates and 20 percent of another. And that's, if my memory serves me, kind of an artifact of political compromise made in the mid '80s following AB-163 --

MR. RAYMER: It was well founded in insanity, the 1980s --

MR. ELEY: And it doesn't really make any sense. If you go across the road between climate zone 3 and 12, all of a sudden you get 4 percent more windows. So I think cleaning that issue up and just having one window area statewide is another thing that speaks to the simplicity issue.

MR. MATTINSON: Did anyone look at the cost effectiveness of making it all 16 percent, for example?

MR. WILCOX: What is the cost effectiveness of changing the glazing area, how do you figure that out, Bill? I mean I think the CBIA guys might argue that the buildings are worth less if the smaller glass areas. Do we want to take that into account, or what? This isn't a cost effectiveness issue, really, --

MR. MATTINSON: Okay, what is it then? Tell me that you don't use more energy in a 20 percent house than a 16 percent house and I'll be quiet, you know.

MR. WILCOX: Okay, well, tell me that in a house with 14 percent glass you don't use more energy when you don't put the right windows in.

MR. MATTINSON: No. Under the standards we've had all these years you use equal energy.

MR. WILCOX: No, you use equal energy to

the guy that has 20 percent glass. See, the big problem here is that the fundamental basis of the current standard says that if you got a 14 percent glass area house you're allowed to use the same amount of energy that the guy who has 20 percent glass uses. And that's the part that's irrational. What's the point of that, you know?

MR. MATTINSON: It's a performance standard; that's the way it works across the board.

MR. WILCOX: Right. It's irrational.

MR. MATTINSON: And it's what has made the California standards more successful, I think, than most any other building standards is the ability to have tradeoffs based on performance. Most of the cases it --

MR. WILCOX: Well, only but -- Bill, we're not changing that; we're not changing the way performance -- the ability to make performance on measures that perform differently. All we're saying is that you can't make that tradeoff based on window area.

MR. MATTINSON: You can't make the most conservation, cost effective conservation move by reducing glass area as a performance tradeoff.

MR. WILCOX: Okay, well, I think, you know, if you could argue that all the houses in climate zone -- in the central valley climate zones with 16 percent glass had 16 percent glass, you might have an argument. But, in fact, see there's basically no relationship between the prescriptive glass area and the actual glass area that people are putting in.

MR. MATTINSON: That's because we have a performance standard that requires them to go beyond the prescriptive measures to offset the --

SPEAKER: That's right, and use an energy consultant --

MR. MATTINSON: -- glass area --

SPEAKER: -- using 16 percent.

MR. MATTINSON: And match up and be the same.

MR. ALCORN: Gentlemen, I need to stop this discussion right now. It's interesting; we have several people that want to comment. And what I'd like to do, our time is completely exhausted on the subject. We have several more comments from folks. What I'd like to do is limit the comments to one minute, please. And then any other comments will come in writing.

And starting with Michael Day.

MR. DAY: Michael Day, Beutler Heating and Air. Is this prescriptive package proposed to be the one that we need to model against with the performance package?

MR. WILCOX: Yes.

MR. DAY: Okay. Effectively you've just saddled a lot of people with a fairly significant increase in the budget, because people like to look out into their backyard. And 5 percent probably isn't -- floor area isn't realistic.

MR. MATTINSON: That's not in the performance. The 5 percent west restriction --

MR. DAY: No, but if the base house --

MR. MATTINSON: -- if I understand, is only in the prescriptive packages. Under performance you could have all the glass on the west.

MR. WILCOX: Yeah, Michael, I'm sorry, I didn't understand your question correctly. The 5 percent limit only applies to west -- only applies to prescriptive. See, that's already in the performance because in the performance the glazing is equally oriented on the standard design house.

MR. DAY: Wonderful. Another point that

I had was that as the lots have started getting smaller over the last few years, and as houses have gotten closer and closer to each other, a lot of the side glass has started to be eliminated. We're seeing that more and more. And it's something that's just started changing in the last couple years. And there's a trend that's really going towards that direction as lots become more expensive.

There are energy benefits to eliminating some of these windows, and that's occasionally driving houses overall below 16 percent. This proposal would eliminate that benefit.

Lastly, multifamily, if you live in multifamily and you give up certain things in terms of having your own yard. What you also get are having conditioned spaces around as many as, you know, four or five of your sides.

You can end up with a much more energy efficient house or dwelling unit because that's something that you give up. The cost to building multifamily is actually going to start going up here, and thank you very much --

MR. ALCORN: Thank you, Michael. Next, Mike Gabel, please.

MR. GABEL: Thank you, Mike Gabel, Gabel Associates. I'll keep my comments to one minute.

I think what the staff is proposing are actually three separate proposals. And I think Commissioner Rosenfeld, the utilities, NRDC and the staff should look at these as separate, because the cost effectiveness of each proposal should stand or fall on its own merits. I think that's very important.

And I also think that if you look at only the proposal of shifting glass from 16 to 20 percent, that thing loses energy; it's going to increase peak loads; it's going to increase total loads. And the reasons given for making that change I don't think come close to warranting that change in that class of buildings again. I consider that one proposal.

I consider the other ones separate proposal. I think the staff needs to redo this analysis looking at each of these three proposals separately, and looking at the cost benefits of each one separately.

MR. PENNINGTON: We wouldn't be interested in them individually. The package is what makes sense from our vantage point.

MR. GABEL: The packages are being used very infrequently. I think --

MR. PENNINGTON: No, no, no, no, these three items together is the proposal.

MR. GABEL: That's right, and I'm --

MR. PENNINGTON: We wouldn't support breaking them apart.

MR. GABEL: But breaking them apart seems to make sense when one of the three significantly deteriorates the performance of the aggregate, and there's no compelling reason to do so. Thank you.

MR. ALCORN: Thank you, Michael.

MR. BJERRUM: Ray Bjerrum with Merzon Industries. I'm representing Western Region AAMA. I will stipulate to Bill Mattinson that windows do not perform as well as opaque walls. That is the best performance, and you can't regulate windows out of the use that the human being. We provide the free ventilation.

So, the window industry would definitely support the proposals that Bruce has given, and would support that and help in any kind of way that we can. Thank you.

MR. ALCORN: Thank you, Ray. Misti.

MS. BRUCERI: Misti Bruceri with PG&E. And first I'd like to say that I agree with Bill that both the single family and multifamily buildings should be analyzed separately. That we shouldn't make a rule that we have multifamily buildings inherently are less -- excuse me, are more efficient per dwelling unit than single family, because of the conditioned space surrounding them. And they also inherently have less window area because of the reduced wall area to floor area.

I don't think we should make a rule that the single family units are allowed to increase their building energy use on the backs of the multifamily. I think they're really different animals and they need to be analyzed separately.

The second thing I'd like to say is there seem to be some conflicting arguments in that we are asking to raise the prescriptive requirements to 20 percent for glazing area. And then also saying that the glazing area won't increase. And I'm not quite sure how we can make both of those arguments at the same time. If it won't increase, then why raise the requirement is my question. Thanks.

MR. ALCORN: Thank you, Misti. Noah, did you have a comment?

MR. HOROWITZ: Yes, Noah Horowitz with NRDC. I agree there are three different things that are being floated here. I'm fine with two of them.

The one that concerns me is going from 16 to 20 percent. What percent of homes will actually increase their glazing from 16 to 20 percent is a big poker game, and I'll put a quarter in and I don't know where it's going.

But the reality is any increase in glazing we're giving up some energy savings without getting any of it back. So, if we're looking at cost effectiveness here, why are we giving away all of that from 16 to 20 percent.

And to Charles' point, you're suggesting having one number makes more sense. And I'd say why 20, why not 18 or of that delta energy, why allow all of it to go away, maybe some percentage needs to be made up elsewhere.

MR. ALCORN: Bob Raymer.

MR. RAYMER: Thank you. Bob Raymer with California Building Industry Association. Very quickly, in 1985 and '96 when AB-163 was being debated, one group for the northern California zones, one group wanted 12 percent; another group wanted 20. The Legislature stuck with 16.

The same thing occurred for southern California when one group wanted 16 and another group wanted 24, and they stuck with 20.

That was how it was decided within about a 20-minute period. And so that was the basis that we've been working on every since.

The problem that we've had particularly with northern California ever since is that our production housing, the ones that I'm so familiar with, aren't using the 16 percent, for starters. And so that's one of the reasons it's led to the continual, very, I would say, argumentative discussions that we've had over the years in terms of the cost effective analysis at the Commission. Of course, they're going to use the basecase packages to develop cost effectiveness from.

But if that doesn't represent the marketable product that we're so commonly using, we're going to be at a detriment right there. We need to sort of be speaking apples and apples.

This gets us in that direction. I would say, I was kind of wondering why the percentage didn't change in southern California, but quite frankly, I know that there's going to be a lot of trepidation about this. And I think it's heading in the right direction.

There's a lot to be gained by having a basecase package that is marketable. In particular, by having something that is, you may be able to use the package as you can't now, for production housing. And that puts the builder, the site superintendents and the subcontractors into the area of understanding the standards at a much greater degree than they do right now.

This is the one area of the building code that is completely disenfranchised from the developer and the builder and the subcontractors. It's ridiculous.

Handicapped access, fire safety, structural analysis, you name it, all of those, the builder has basic understandings, the subcontractors do.

This, you've got to have an outside consultant come in. That needs to stop. We need to be able to at least have an option of doing this so that we can get the knowledge, the education back to where it needs to belong, to have very strong implementation and effective implementation of the standards. It also makes enforcement easier.

Thank you.

MR. ALCORN: Thank you very much. I think we're going to have to close off this discussion for now and move on to the next topic. The next topic is improvements for existing homes, ducts. And Mark Modera will be making the presentation. He's graciously said that he would try to accelerate to make up some time on this topic.

So, thank you, Mark.

(Pause.)

MR. MODERA: Okay, they asked me to go quickly, so I'll skip every other word. So if it sounds like I'm stuttering, that's why.

Basically what I'm here to talk about are two proposed changes. One is to require duct sealing at the time of HVAC equipment replacement; and the other is to require that when you replace a duct system that it be sealed, and that it's R value be increased to R-8, as opposed to the nominal R-4.

Next. In brief, compared to some

existing standards in new construction in the basecase house you have a requirement for duct tightness. That requirement is at 6 percent. In this case we've relaxed that to 10 percent. The reason being some of the access problems associated with sealing ducts in existing building versus a new building.

Very similar to a new construction and require the installer to test at all sites. And requires some form of third-party verification.

Next. In terms of the third-party verification, it will again follow very closely to what's done in new construction. There will be differences, and there are some details to be worked out on that.

But there will be a sampling procedure. The sampling procedure, in the case of new buildings, the issue is you have a specific model and there are rules about how to deal with sampling so many, going through that model. And then you test the first one; and then you'll -- have to test the first one in every model, and then you'll have a procedure for testing one out of seven after that, and the procedures what happens if somebody fails.

In this case, there's no model to deal with, so there are some changes associated with how to deal with existing buildings, because they're all one-of's. But it will be a similar sampling procedure. You can see what's in the proposal that's been posted on the web.

It will involve HERS raters. And we also are putting in the possibility to use certain data collection or verification of validation entities that can help reduce the sampling requirements in existing buildings. It's more of a cost, and more of a disruption to business to do it in existing rather than in new construction.

However, we have an option that if someone has a way to do that more efficiently, that's a possibility.

Next. Okay, what this says here is sealing alternatives. And what this is, is the basecase was to require somebody to seal the duct system when they replace the air conditioner. But if they decided not to, there should be some alternative. And you notice in bright red letters there it says sealing alternatives to be changed.

And the reason it says to be changed is that the way that we built this in here, this was essentially, these were requirements to increase either the SEER or the EER rating or the AFUE of the unit that's installed. Again, this is occurring at the time of equipment replacement.

What happened was we sort of figured out that the reason we were doing this was to avoid the third-party verification that goes along with duct sealing. But if you're going to have EER requirements, it would still require third-party verification.

And therefore we figured out that there will need to be alternatives, but sort of somewhat at the 11th hour, figured out that this is probably not the way to do it. What we'll be looking at are things like adding additional insulation, say attic insulation, or something along those lines, as an alternative to doing duct sealing.

In these alternatives also includes insulating the ducts. There are two columns there. One is insulating the ducts plus an equipment efficiency increase. And the second is simply equipment efficiency increases.

The likely sort of final proposal or the revised proposal would be to require some sort of insulation in addition to insulation of the ducts.

Okay, in brief, this is somewhat blurry. What it shows here is it shows the blue lines are the costs; the first two blue lines are for duct sealing in an attic and a crawlspace system respectively.

And then the second two blue lines are for duct replacement with type R8. And the blue lines represent the marginal cost.

The maroon lines, maroon bars represent the lifetime benefit calculated simply based upon energy savings. And the yellow lines are based upon using a time dependent valuation energy savings.

One thing you can take away from here is that you can see, and this is not surprising, that duct efficiency improvements have a larger impact when looking at it from a TDV perspective as opposed to from a strict energy perspective.

Okay, in terms of coming up with statewide benefits, why are we thinking about doing this. I didn't give you any of that as background, so I'm sticking my background in my benefits VuGraph.

And basically roughly 60 percent of the

HVAC equipment that gets installed in California each year gets installed in existing buildings. And the fact of the matter is that existing buildings have a higher baseline energy use, which means there's a lot more sort of energy savings potential in those buildings as opposed to in new construction.

The other thing in terms of statewide benefits, is we looked at it from an energy and peak demand savings. Those numbers that I show you there, what those represent is each year that the standard would be in place, if it were followed completely.

And I will grant you immediately that it's not going to be followed completely. We did a little bit of background on trying to figure out how often somebody actually pulls a permit when they replace an air conditioner. And depending upon who you ask, that number ranges between 10 percent and 50 percent of the time.

So, in addition to the proposed changes to Title 24, what we also propose is that there be some sort of public awareness campaign to increase the incidents of people using permits when they replace air conditioners or furnaces, et cetera.

The numbers that I show you there are, if all of the buildings with leaky ducts actually do get sealed at the time of equipment replacement, and that's the annual number each year that it's in place.

Finally, I guess what I'm talking about benefits here, one thing I guess I didn't point out, because I was trying to go quickly, but I'm going to backtrack a little bit.

Going back to the previous one where I showed the equipment efficiency tradeoffs, what you'll see if you look at that is you had to have rather dramatic increases in equipment efficiency to get equal energy savings to the duct sealing option. And that's, I think, an important fact moving forward in this discussion.

Finally, I'm not going to spend a lot of time on this. In addition to the energy savings there are significant comfort and IAQ benefits associated with improving the duct system rather than just focusing on the HVAC equipment for HVAC.

Next. Okay, in terms of the assumptions behind all of this, what it's based upon is assuming 15 percent on the supply side; 15 percent on the return side, as the average leakage that you start with.

A 30-year measure life. The sealing costs were taken from the energy efficiency cost databases that had been developed by Xenergy for the Energy Commission. That's for existing buildings, duct sealing and testing by a contractor.

And then the insulation costs, the marginal cost of going from R4 to R8, I was able to obtain that from Owens Corning.

To come up with the numbers, the benefit numbers, I used a 70/30 split attic to crawlspace. It actually doesn't have much of an impact. And a 70/30 split on seal and replace, which also doesn't have much of an impact.

Next. To get the numbers I generated Ken Nittler used MICROPAS; plotted to a 1978 prototype house. And then we actually used 75 percent of those values. In other words, the energy consumptions that come out of the simulation, we knocked those down by 25 percent to account for the fact that most people don't want to spend that much money on energy and probably are not using it on their system on a full-time basis.

We also used as a baseline AFUE 80 and SEER 12, and the reason we used SEER 12 was because these standards will be going into effect in 2005 and then the federal standards for equipment efficiency would go on in 2006. So it seemed appropriate to not base it on SEER 10, but rather SEER 12.

The only impact that that has is if we had used SEER 10, then the cost effective numbers would be even higher, which was sort of not necessary in this instance.

The time dependent valuation, it uses hourly duct efficiencies and valuations. And then finally to come up with the peak demand estimates, we used 60 percent of the values that would be generated by ASHRAE standard 152P.

Next. Last VuGraph. In terms of specific changes, the changes that are being proposed are in section 152 B1B, that's where the duct sealing requirement will appear. And then there's a new section 452-B1D that calls out the requirements R8 and verified tightness for replacement duct systems.

In addition there'll be a new section in the ACM, section 7.4.4. And finally appendix F has to have a modification of four alterations versus for new constructions to require 10 percent instead of 6 percent.

And finally, the residential manual, there's some changes in that to make it consistent.

Did I do it in five minutes? How did I --

MR. ALCORN: Pretty close, thank you very much, Mark. Appreciate you accelerating through that. I'd like to recognize Marshall Hunt with a question or comment.

MR. HUNT: Marshall Hunt, Pacific Gas and Electric Company. I want to thank Mark for this really good report.

I want to build off Mark's statement of the technical potential. One of the key reasons that we're bringing this forth is because of the extremely high potential savings here. And because, as has been pointed out by Bob Raymer of CBIA, that we know there's a tremendous problem out there in existing systems. And we need to look at this seriously.

And this technical potential that does exist can only be accessed if we solve a great many of the implementation problems. And right now we are researching that further.

But rather than hold up the release of this document to another workshop in the future, it was my decision to let this go ahead and in this draft form. Because we want to hear from everyone and get this on the table.

There is a lot of details to be worked out. Someone once said the devil is in the details. What are the offramps; when do you run into situations that you have to just back off from.

One thing comes to mind. What about asbestos in the duct work, things like that. When is the triggering event. All kinds of issues.

But we need to keep our eyes on the prize which is the tremendous potential for saving energy out there. And how many times have we had the situation when a customer has spent thousands of dollars on a new system, only to be very disappointed that they still don't have things fixed.

Also, verification is a big issue in the retrofit market. So we have a great many things to work out. And we're open, I personally -- very open to getting input from relevant parties, everyone here. And so please treat this as it is, a proposal. We need to work out the details, and we will be working with experts in this field further.

And again I thank everyone's input in advance.

MR. ALCORN: Thank you, Marshall. Bob Raymer.

MR. RAYMER: Yeah, two points. Bob Raymer with CBIA. The first one, the study and research analysis that CBIA did with Lawrence Berkeley Laboratory and the Energy Commission in the mid '90s on ducts and duct leakage is a matter of record.

We were looking at new construction and we obviously found a problem that needed enhanced quality control. Given the dramatic findings that we did come across, I shudder to think what a 25 to 30 year old duct system out there looks like right now.

Just simply getting a high efficiency air conditioning unit and slapping it up to the existing duct system with little or not oversight of that duct system is a big mistake.

We certainly applaud the Energy Commission's efforts to look into this effort. And there could be magnificent rewards.

The down side to this, and that is something that we're going to have to explore with the building officials and whatnot, is to what extent is the actual current inspection process going. Is this going to be an unfunded state mandate on the building departments.

These are things that we're going to take great interest in, but we certainly want to assist the Energy Commission in forging into this area. There's huge benefits to be reaped here. And right now, just simply buying, whether it's expensive or not, buying that high efficiency air conditioning system and not having some type of quality control over the duct system you slap it onto, is a mistake.

Thank you.

MR. ALCORN: Thank you, Bob. Steve Gates.

MR. GATES: Steve Gates with Hirsch and Associates. Question for Mark. The requirement is to go to R8 ductwork where you're replacing ductwork. There's R8 ductwork with just a regular polyethylene jacket; there's also R8 ductwork with an aluminized metal jacket.

Given that these are existing houses, virtually none of them will have radiant barriers in the attic. And it's well known that in attics the primary mechanism of heat transfer in the summer is via radiation.

I think it makes tremendous sense not only to require R8, but to require R8 with an aluminized jacket on the ductwork so that you can cut down the heat transfer due to radiation.

So I'd suggest that be looked into. And I certainly agree with the previous comments that, you know, old leaky ducts are a huge potential source.

I'm a little concerned about some of the application details in terms of where you have ductwork that's in an attic with blown insulation and the diffusers are out toward the, you know, the perimeter of the attic where you have very limited access, you know, three or four feet high with, you know, blown insulation underneath it. It'll be interesting to see what requirements you come up with in terms of jeez, how do you actually get out there and deal with those types of issues.

Maybe it makes sense to actually address retrofits in insulation as part of this in some situations where you don't have much.

But anyway, that's just kind of a speculative comment. But the main point I would like to make is the concerns about radiant heat flux in an attic, and how you can minimize that impact on a duct by going with a metalized jacket.

MR. ALCORN: Thank you, Steve.

MR. PENNINGTON: Do you want to respond to that one thing?

MR. MODERA: About the metalized jacket?

(Pause.)

MR. MODERA: Well, one reason I didn't analyze that is I didn't have data available on what the energy performance would be. And that would be -- and it would only work in attic systems. So in terms of the complexity of what I was proposing, it's not going to do me much good to have that analysis for a crawlspace.

But, in addition, there's the issue of are there published values that show sort of how those perform. The data that I was aware of had said that although they put the aluminum coating on them, it wasn't acting as a radiant barrier was because of the fact that on the ductwork there's a plastic film on the outside that was increasing the emissivity.

I don't have anything against doing something about that. It's just I didn't have any data to support that kind of a change.

MR. GATES: Good question, and I don't have an answer for you. Have you talked to the duct manufacturers directly to see if they have any information?

MR. MODERA: Not on the -- no.

MR. WILCOX: My understanding is the same as Mark's, is that there is no such thing as a duct with a radiant barrier. If there was, it would be a very interesting thing to include.

MR. GATES: Okay, points well taken, and I assume that since it was metalized and at least semi-reflective -- could argue that well in five years later it'll have a coat of dust over the top, and even that's true. But --

MR. MODERA: I wasn't even going there. I just remembered that because there was a plastic on top of the aluminum that I'd heard that it didn't work so well.

MR. GATES: Well, clearly anytime -- I

mean, you can -- anytime you have a shiny surface it's more reflective than one that's not. But in terms of the extent of that, I can't answer that.

MR. MODERA: Yeah, it's a function of -- that's basically what happens.

MR. GATES: Yeah.

DR. AMRANE: My name is Karim Amrane and I represent the Air Conditioning and Refrigeration Institute, ARI.

I would like to start by saying that ARI believes that ducts should be properly sealed and properly insulated. And we commend the Commission for attempting to address this very important issue.

However, reviewing the proposal we have a couple of concerns. And the first concern is with respect to the fact that the duct sealing requirement will be triggered when the HVAC unit would be replaced. We believe that the two shouldn't be linked together.

As a matter of fact, we believe that would be counterproductive to what the Commission is trying to do.

And let me try to illustrate this with a simple example. If this proposal goes through you will make a replacement unit a very expensive option. Consumers, if given the option to either fix the old unit or replace it with a more efficient unit, will probably choose to fix the old unit, because now they'll have to add an additional $1000 to fix the ducts.

So what we believe should be done is simply make it a requirement. Ducts must be sealed, period. Don't link it to the replacement of an HVAC unit or furnace, for that matter.

The second concern we have, of course, is with respect to this alternative that we have here that's going to be modified. As proposed, giving the option not to seal the ducts, but then to install the 14 SEER or 13 SEER unit is not right. It's wrong, as a matter of fact.

The message you'll be sending is to the consumers that it's fine to waste energy when you have a 14 SEER unit, but it's not fine when you have a 12 SEER or less.

So, again, what we feel is appropriate is for the Commission to mandate duct sealing. And I'll leave it up to you to find a way of doing it, but that there might be, can use some suggestions.

Make it a requirement when the house is sold, for example. Or make it a mandatory inspection. Or do it through tax incentives. But there should be ways of encouraging people to replace, to seal the duct or to insulate the ducts.

And I would like to conclude by saying that we'll be happy to work with the Commission on this issue anytime. Thank you.

MR. ALCORN: Thank you.

MR. RAY: Thank you. Michael Ray with the Trane Company. We appreciate the opportunity to discuss the issues raised by Pacific Gas and Electric, the duct sealing requirements upon HVAC or ductwork system replacement.

Trane is a strong supporter of NATE, North American Technician Excellence and ACCA, Air Conditioning Contractors of America. We commend PG&E for drawing attention to the issue of leaky ducts and to the Commission, as well.

Trane agrees that there can be energy savings associated with proper sealing and installation of ductwork, and encourages duct sealing and insulation.

The issue is the amount of additional

energy needed due to the leakage of the ductwork. Substantial energy could be saved by focusing efforts towards the permanent sealing of ductwork.

We oppose any requirement for higher efficiency air conditioners or heat pumps to offset deficiencies in duct work.

To state duct sealing can also improve indoor air quality and safety principally by reducing entry of outdoor pollutants into the living space, including reduced ozone entry during smog alerts, reduced entry of car exhaust, pesticide and other toxic fumes from garages, reduced energy, dust, soil, gases or pesticide fumes from crawlspaces is a stretch, at best.

Should the house be under a negative pressure, the edges of the walls, the windows and points of infiltration will draw in the same pollutants.

Trane encourages the independent contractor or dealer to obtain a building permit where required by law. We agree that all dealers or contractors should be encouraged to obtain the appropriate permits.

To state, and I quote, "the key issue with respect to enforcement of this change in the standards is the significant fraction of HVAC equipment that is installed without building permits. This proposal does not address that issue directly, but rather proposes several alternatives for helping to increase the use of permits" unquote, is really not well thought through.

Under the proposed standards should an evaporative coil need to be replaced, might not the contractor or dealer be tempted not to pull a permit. Note that we don't condone such an act.

The contractor, being faced with a -- facing the customer with a $500 to $1000 bill for changing the coil, does the dealer or contractor also want to burden the customer with an additional $1000 or more for replacing ductwork or sealing and insulating the ductwork on their house. It's a difficult situation.

We've already noted that the inconsistencies in the climate zones in the table chart, and you've noted that things will be changed there, so we won't get into that.

Trane opposed tying the air conditioning and heat pump energy efficiency to the separate issue of duct sealing and insulating. We agree that sealing of ductwork needs to be addressed. If the ductwork is defective, fix it.

We appreciate the opportunity to discuss this issue with you. And we offer our assistance, as well, should you have any questions or request that we assist you, we'd be more than happy to do so.

MR. MODERA: Can I give one response?

MR. ALCORN: Sure, of course.

MR. MODERA: My response would be to the stretch in terms of explaining why the duct system would pull in pollutants.

It's true if a house goes under negative pressure the stuff would come from your crawlspace just the same. But all the research that I did during my career basically show that every time the air conditioner clicked on, the air exchange rate would triple. Or if the furnace kicked on, it would triple.

So, you're increasing the amount of air going through the house by a factor of three. And so when we did studies, the ozone, where that comes from was when we did studies of looking at what was the biggest determinant of indoor ozone exposure, it was whether or not they had an air conditioner in their house.

And then if they had an air conditioner, whether or not the ducts leaked. So that's where that came from.

And in terms of the entrainment of car exhaust, et cetera, what that's referring to is leakage in platform returns in garages, which in fact has been measured. That stuff doesn't get made up.

MR. RAY: When the air conditioners kick on does not the house then go under a negative pressure at that point, too?

MR. MODERA: Not necessarily.

MR. RAY: Is it not possible that in the testing that that's what occurred in the house, though?

MR. MODERA: Okay. An air conditioner is not supposed to change the pressure in the house one iota if it's operating properly. The only way that it changes the pressure inside the house is if the ducts are leaking, or if there's an outdoor air intake, a purposeful outdoor intake, like an economizer for a commercial building.

But, in general, when the air

conditioner kicks on, if the ducts were tight, the pressure in the house shouldn't change. You shouldn't go to a negative pressure.

And so if you have more supply leaks it'll go negative; if you have more return leaks it'll go positive. But the point is the overall exchange of air is going up by a factor of three.

MR. RAY: Well, and we don't disagree with you. We feel it's very important that the duct issue be addressed.

MR. MODERA: I understand. That was what the rest of your comment sounded like. But the one, the bit about the -- I just wanted to respond to the one thing, that's all.

MR. RAY: Okay.

MR. ALCORN: Okay, thanks. Tom Trimberger.

MR. TRIMBERGER: Tom Trimberger representing California Building Officials.

This is one of the recommendations that really concerns us the most of all the things we're looking at.

And I brought this up before, but this making mandatory changes to existing houses for things that you're not working on is not legal right now. You cannot do that in California. The state building code covers, the housing law says if you're not dealing with this part of the house, if you do this, you can't be made to upgrade that.

If you're changing out the air conditioner, yes, the air conditioner needs to be brought up to code. But the ductwork doesn't. Same as we've done with windows. I've talked about this before. This is something that's going to have to be worked out, the housing community development, legal issues, I don't know how than can get resolved.

MR. PENNINGTON: We have had discussions with our attorneys since we last talked about this. And we're convinced that we don't have a legal problem, as you're saying.

MR. TRIMBERGER: Is housing community development convinced? Are others convinced?

MR. PENNINGTON: The language that you're speaking about affects them, and it's their interpretation of their code that that is what you're speaking about.

MR. TRIMBERGER: Okay, it affects me, also. I'm the one that deals with both codes.

MR. PENNINGTON: Well, yes, because of

their interpretation of their code, it affects you.

MR. TRIMBERGER: And because of the way you interpret your code is going to affect me. Same thing, Bill.

(Laughter.)

MR. TRIMBERGER: I'm in the middle here.

MR. PENNINGTON: We do not believe that we're constrained by that requirement.

MR. TRIMBERGER: That's what you've always told me, is we don't believe we have a problem yet.

MR. PENNINGTON: We revisited it since we last spoke.

MR. TRIMBERGER: Okay.

MR. PENNINGTON: And we don't think we have a problem with that.

MR. TRIMBERGER: Going on, a couple of things. Enforceability, enforcement issues, I'm blown away that you're even looking at sampling on replacement houses. You know, you can replace the units on four units and then you go do the fifth one, and it's duct layout is completely different. It's got cabinets or something. It's got conditioned or ducts in building construction which was put in legally, and that's one that gets tested. And so you get nailed for all the previous ones?

I think sampling is an enormous error, period.

We have enough problem looking at getting permits for these. This is a big issue for building departments. How do you get these things to get in there.

Even, you know, we generally issue permits at such a price loss, you know, as a percentage of the valuation for a $4000 HVAC remodel, we get 52 bucks to issue all the permits, go do everything, go out, go do one or two inspections, driving time. You know, we're already subsidizing these small permits so heavily to try to get people to do a permit, to get a permit. And now you're going to add $600 is I think what it looks like, which even looks low to me.

You're going to have a tremendous disincentive to get permits. I think you'll have a disincentive to replace the units. You know, in some occupancies, clinics and hospitals and things, they'll spend $50,000 to rebuild a five-ton rooftop package unit, because they know if they've got to put a new one on, it's going to trigger all sorts of new requirements. So they'll completely rebuild it ground-up.

A lot of people I talk to in the industry they say, yeah, when we go out and give an estimate we'll throw in already, we'll do a duct sealing for this, without any mandatory requirement. They'll offer that as an option to the buyer.

One other thing, looking at R8 would be a minimum requirement then, is that the minimum requirement for new buildings, as well? Why is it for old buildings, but not new buildings?

MR. MODERA: I thought the other proposers were likely to do that. I was going to make it consistent.

MR. HUNT: We're going to analyze the duct insulation as part of another proposal that --

MR. TRIMBERGER: Okay, that looked odd to me that we were looking at not only were you required to do, you know, update something that, you know, the ducts when you weren't planning to touch it, but you got to make it better in a new house. That would have trouble flying.

MR. PENNINGTON: We can't get all of our proposals together on one day is our problem.

MR. TRIMBERGER: How are the costs of new ducts or sealing ducts, replacement ducts --

MR. McCARTHY: By the way, I was thinking to try to respond, to sort of keep track of everything and then respond. But I'm starting to think that there may be too many that we should maybe respond to --

MR. TRIMBERGER: That's basically my last issue, my last question.

MR. MODERA: Okay.

MR. TRIMBERGER: Other than to say that, you know, there may be other things, rebate programs or other measures to try to get duct sealing. But to mandate that with an air conditioner replacement is extremely heavy-handed.

MR. MODERA: Okay, I'll try to respond as well as I remember. If I miss any, remind me.

Going backwards, from the question of the costs, the costs for the sealing came from, it's called the DEER study, which was done for the utilities and for the California Energy Commission by a company called Xenergy, who does a lot of analysis of energy efficiency measures.

And they've studied mostly utility programs in the state where people were going in on the retrofit basis and sealing ducts. That number, what was added onto that number was a cost of doing testing, doing verification on one in five. And so that ended $30.

If you were to increase that to have to test all of them, it would increase that by another $120. So if you said you're going to have to pay $150 each time for the third-party verification.

The cost for the insulation came from simply I called Owens Corning, who's a big manufacturer, and had them chase me down what it costs to go from R4 to R8. And that was where that came from.

MR. TRIMBERGER: I just wanted to make sure that they were looking at it; it cost a lot more to, you know, crawl up through an attic and drag your duct up through an attic, than it is to put it in when it's brand new.

MR. MODERA: Okay. The only time the R8 comes in is if you're already replacing the ductwork.

MR. TRIMBERGER: I'm looking at duct sealing or duct replacement. What are we looking at as far as duct sealing? How do you fix the house if you get a house, you're changing out the A/C, and you've got to somehow get into where ducts are and get them sealed or replaced? And what is the cost of that?

MR. MODERA: Well, in general, that's where that number for the DEER study came from, were contractors that go out and do that; who were doing that as part of the utility rebate programs.

Let's see. Going back to the idea of sampling. The issue of, you know, the fact is that you don't have a model, and I understand the premise of the way that it was done for new construction. Which is to say, you have a given model, and then once you know how to do that given model, you should be able to reproduce it on the next ones.

MR. TRIMBERGER: No, that was changed.

MR. MODERA: Well, I understand that the rules were changed, but that was sort of the thinking behind it, from what I -- how it was what it was.

And then, how do I say, putting that

aside, let's try this another way. If you just say what you're testing when you go and test whether that contractor's performance, is the contractor should have tested every system. And shown that it got to a certain level of leakage.

So if they're testing it's not going to be a big surprise that all of a sudden the one that comes to get verified is the one that fails. You understand what I'm saying.

And so that part of the sampling I don't think is an issue. The issue of the sampling, a bigger issue is like Marshall said, I mean I don't believe we have everything nailed down right, as to what exactly the right way to do that.

The bigger issue on the sampling is dealing with the fact that you've got tighter timing issues in terms of the contractor going to houses, pulling a permit right away, and then having someone come back later on. And depending upon what kind of contractor it is, and production homes, it's pretty straightforward, right? Because they're doing it, it's like a production schedule.

But some contractors will only be treating two homes a month; whereas other ones will be treating 50. And so how big you make the sample size for when you'd have to go back. All of those issues, I agree, have to be dealt with.

And I would, personally I would love to work with you to try to figure out -- the goal here is not to make people pull less permits. The goal is to make people pull more permits. But you need to somehow do that some way outside of just this little proposal I put forward here.

MR. TRIMBERGER: Okay, I have one last comment. With the AB-970 2001 standards we've already built in there for new production clean, easy houses, a methodology and a requirement -- not a requirement, a prescriptive method for duct sealing. And people are not doing it.

They are paying the price financially for more expensive measures to gain compliance because they don't want to do on this nice clean job what we're trying to mandate for every single messy A/C change-out.

MR. PENNINGTON: I don't quite understand that, Tom. Isn't the largest mechanical contractor in northern California doing duct sealing routinely?

MR. TRIMBERGER: They are, but not

routinely for compliance, no. The ones we're getting now, for AB-970 compliance, are still the neighborhood of 5 percent are claiming it for compliance.

And I think that if you -- everything we've talked about statewide bears that out. I don't think that's under debate.

MR. PENNINGTON: One of the statements that was made at the last workshop by Rob Hammon from ConSol, is that already, after only, you know, these standards being required for all residential housing for only four months, that 40 percent of their clients were doing duct sealing.

So, we are certainly in a transition.

MR. TRIMBERGER: Maybe you've seen it, but I haven't.

MR. ALCORN: Okay, we have just a couple of -- we're into the lunch time -- we've got a couple more commenters. If we could keep short comments from Noah, Ahmed, Tom Hamilton and Dave, I think, one other individual in the back.

So, yeah, Noah first, please.

MR. HOROWITZ: Okay, Noah Horowitz, NRDC. I'll be brief.

I think this is a very compelling

opportunity worthy of continued consideration. Some of the details of how do you pull the permits and some of the things that Marshall pointed out, hopefully there could be continued thought.

I want to quickly reflect on some of the points made by ARI. I was delighted to hear that you said ducts should be sealed and insulated. But your caution was don't use replacement as the trigger, but make every duct in the state tight.

Well, I would love to see that happen. I'm also realistic and I think this is an important first step. And we'd be delighted to work with you on those other avenues. But I still think this trigger needs to be in there.

There's also been some talk that this is going to be a disincentive to replace an existing unit. And I think on residential homes, if somebody's unit breaks, they're going to replace it, even if this duct requirement is there. They're not going to go without air conditioning.

MR. AHMED: This is true.

MR. HOROWITZ: And we'll see how that plays out. So, that concludes my comments.

MR. ALCORN: Thanks, Noah. Ahmed.

MR. AHMED: I just have some very simple question here, Mark, regarding existing buildings, how will you define them? Because if it's a home that's, say, been built five years ago, and the air conditioner breaks down, does this homeowner now have to go through tight ducts and installation of sealing of ducts and things like that, when probably the ducts are already well sealed?

MR. MODERA: The way it's defined is if they're already sealed, they're sealed. It's not a requirement to seal your ducts. It's a requirement to test them to be below a certain leakage. So if it was built five years ago with tight ducts, it should still have tight ducts, you don't have to seal them, you just have to --

MR. ALCORN: But the homeowner will have to pay now for the ducts to be tested.

MR. MODERA: As part --

MR. AHMED: An additional cost will be there, which normally right now they don't have to.

MR. MODERA: Okay. What I did is I looked at the data that we had, because part of what I spent a lot of time on was working with a company that sealing ductwork and getting data from the field.

If we look at that data it says that roughly 15 percent of the houses wind up having not enough leakage to need to be sealed. And the rest of the houses would need to be sealed under these requirements.

So that means 15 percent of the time it's true, you would be -- would be expending the extra cost which at the time of installation, you know, they're not calling in a third party necessarily at that point. At the time of installation it's probably only $100.

MR. AHMED: But these homes that you look at what were the ages of these homes?

MR. MODERA: It was a pretty complete spectrum. I haven't looked at it statistically stratified to say, you know, what age group was represented in what way, see if the 50 percent were all the new houses. But that -- my cursory examination of that suggested that wasn't the case.

MR. ALCORN: Okay, thank you. The gentleman behind Bob Raymer there.

MR. BJERRUM: I would just like to support Tom's position here on tight ducts. As we went through AB-970 it was said that there would be all of this training and people would come on board.

And I'll tell you, in Fresno we watched -- we're aluminum window manufacturer and vinyl window manufacture; and aluminum windows went like down. And there isn't, to my knowledge, anybody doing tight ducts. And it's because of the complication of that timeline.

And that's what I really went out and tried to push, the fact that I could find some CHEERS guy, get them together, and this timeline of having the registers up and getting it to pass, and then having to correct it, when you have to bring a house out into selling it in the next week.

If you could go to, as I said before at AB-970, if you could go to some sort of a certified HVAC contractor and certify the contractor, and that might work for the replacement. Because the tight ducts aren't working as well as you'd like to think in getting them going, so that's my point.

SPEAKER: Because of the bureaucracy.

MR. BJERRUM: Huh?

SPEAKER: Because of the bureaucracy.

MR. BJERRUM: It's the timeline --

MR. ALCORN: Tom Hamilton.

MR. HAMILTON: Tom Hamilton with the California Home Energy Efficiency Rating System. We're a HERS provider that does the tight ducts. We're seeing a doubling of tight ducts every month for compliance purposes statewide.

The issue related to AB-970 was there was a grandfather clause that I don't know if -- for large production builders, where really they didn't have to start submitting for permits until the beginning of this year that would require compliance.

Those homes won't start coming online until probably summer, late fall. As Bill had mentioned, Rob Hammon had indicated that about 40 percent of his product is using tight ducts. In a lot of the hotter climate zones you have to use tight ducts for compliance. And as I said, we're seeing a doubling, verification now, doubling from one to two is not a lot, but --

(Laughter.)

MR. HAMILTON: -- this month we'll probably do about a thousand verifications. Last month we did about 500. We'll do about 1000 in May. We're expecting to see that number dramatically increase.

Certainly there's a lot of implementation issues relates to this for existing housing. As Marshall said, the details are important. One thing that should be considered that wasn't mentioned is the impact for the legal issues is because of AB-549, that one of the responses to that that has to go back to the Legislature is that maybe there is a cleanup of the legal ramifications, or at least a better opinion of who has jurisdiction and who supersedes who. So, that's it, thank you.

MR. ALCORN: Thanks, Tom. Dave.

MR. WARE: Dave Ware, Owens Corning. I just want to clarify a couple of things that Steve had mentioned earlier about metalized jackets.

I provided the costs to Mark by contacting J.P. Lanborn, John Lanborn. John Lanborn then went out to the four other predominant manufacturers of flex duct material in the state and averaged all those costs. So they weren't necessarily represent -- the costs that were provided to Mark weren't Owens Corning costs, but representative of all manufacturers and the products that they purchase.

I pursued it further, asking the question of metalized jackets, because the numbers that came back from John Lanborn indicated that the cost for metalized jackets averaged anywhere between 5 to 10 percent. But it was regionally oriented.

So the question was what's driving that. Is it a climate situation; is it a building type; is it availability of product. Nobody really knew. Okay.

But it was evident that the manufacturers that are providing the jackets have very little data on reflectivity and emissivity of the product. They just do not have that. There are performance specs, primarily for moisture control, air erosion and fire resistance that the jacket has to conform to from a health and safety standpoint. And that's as much as what they know now.

So I thought that would be a good area that we ought to pursue, as well, -- for new construction as well as for additions and replacement of equipment. But it just doesn't seem like there's enough information on that issue at this time.

The second point I wanted to raise, I think Ahmed brought up, is the new language that is being suggested here. And if I'm understanding Ahmed's point was if a home is only five years old and took advantage of duct sealing; and now there's some replacement of equipment or an extension of equipment or something like that, do they have to do it again.

And so I guess the point is can they not use the same certification or verification on the duct equipment sealing and leakage as they had before to verify this. The language isn't quite clear on that perspective.

MR. MODERA: I agree that the language should be clarified. I can tell you what my intention would be. Is that it would be good to have them test again, because a lot of times in the percentage that's there is the percent of loss in the equipment, also.

And so when they hook up the equipment a lot of times if they do a sloppy job putting it back together, you want to pick that up.

MR. WARE: Thank you.

MR. ALCORN: Go ahead.
MS. KHAN: My name is Jamie Khan. I'm representing Lennox, International. We agree that improving the duct system, tightening the duct system and reducing the leakage is a great idea. And pursing that is a good idea.
However, we are concerned about tying that to the repair of air conditioning units; and are also concerned about the alternative approach that has been suggested of purchasing high efficiency units.
So we would basically agree with the comments that were given earlier by Karim and the gentleman from Trane. And would be interested in helping or assisting in any of the pursuits. Because I understand this is a draft in this proposal stage. And we'd be interested in participating in the system as it goes along.
Thank you.
MR. ALCORN: Thank you, Jamie. One final comment.
DR. AMRANE: Just a quick response to NRDC's comment that when the unit fails it is replaced. I mean that's not the case at all. As a matter of fact, in this particular case, now

that you are adding another $1000 to the replacement of the unit, I mean fixing the old, less efficient unit probably would be the best option here for the consumer.

So that's why we see this as currently -- as being a lose/lose situation. Not only you will keep all less efficient units, but you won't be even sealing the ducts, as well.

So that's why we don't want this linkage between the replacement.

MR. PENNINGTON: It seems like there's a lose/lose situation with attaching a new air conditioner onto a leaky duct system, also. That the consumer is going to lose big time in terms of not realizing the benefit of that.

And also the manufacturer will lose, because of potential callbacks associated with that.

MR. AHMED: And we agree with that, as well. That's why we are asking make it mandatory, fix the leaks and be done with it.

MR. PENNINGTON: Well, we really don't have to --

MR. AHMED: Don't link it to higher efficiency unit; don't link it to --

MR. PENNINGTON: I think you need to understand there really isn't any authority to do that. Or any obvious mechanism to do that. What would you do? You would require all houses -- you'd go down the street and require everybody -- I don't understand, you know, --

MR. AHMED: I mean I leave it up for you to come up with some options --

(Laughter.)

MR. AHMED: As I said, one option could be to have tax incentives to encourage people to do it. Or you could have it do it during the sale of a house, make it a requirement then.

I think there are options.

MR. PENNINGTON: We have no authority to do that, what you just said.

We do have authority to effect, through a building code process, alterations to buildings. And, you know, we have a little disagreement with Tom about what our authority is, but we're convinced we have such authority --

(Laughter.)

MR. TRIMBERGER: You just told me you didn't have authority with the sale of the house. I'm not sure how you got authority to do duct work when you're changing an air conditioner.

MR. PENNINGTON: This is an alteration, so we have the authority to affect an alteration.

MR. TRIMBERGER: Why don't you insulate the whole building while you're at it; change out the windows.

MR. PENNINGTON: I mean the logic here is that this is a major opportunity that is associated with --

MR. TRIMBERGER: I agree.

MR. PENNINGTON: -- replacement of this particular thing. I mean think of this as a system, not just as a widget. Don't think of the air conditioner as a widget. This is a system, --

MR. TRIMBERGER: As is the insulation in the attic and the windows.

MR. PENNINGTON: Well, we're not proposing that. Maybe we should. Maybe we'll get there. But at this point we see this as, you know, this is a major opportunity.

You've got an opportunity cost here. You've got the mechanical out there, all the costs that it took to get the mechanical to the building site, you've already paid for.

Hook up the equipment and test the darn

thing and make sure it's not leaking.

DR. AMRANE: Again you're assuming that that someone will replace the unit instead of fixing the old unit. Because here I think the option would be clear, I mean consumers would fix the old unit instead of not only replacing the unit, but then adding another $1000 to fix the ducts.

MR. MODERA: I guess I would like to make one comment relative to that. The numbers that I used for costs were for stand-alone duct sealing, which means that you have to have all the costs of going out and selling the job; all the costs of driving out to the site. It's a stand-alone job. In general, it's much easier and the costs can be much lower.

But I didn't mean to try to stretch it that way because of the cost effectiveness, to try to take advantage of that. But the costs are much lower if you're making it part of a job where you guys are already on the site. The marginal costs to the consumer can be much less.

In addition, by the argument that they would choose not to replace their equipment, that would argue that nobody is ever going to upgrade to go to higher efficiency equipment, which they do.

DR. AMRANE: Yeah, well, without this duct sealing requirement.

MR. MODERA: Without it. So people are willing to pay the extra money to go to a higher end product in that instance, so that that's not very different from saying, well, the requirement says that we need to seal your ducts. But, look, here's the payback. It's actually better than going to the higher efficiency equipment in the -- if you look at the -- for convincing consumer rather than fixing it they should replace it, say not only will you benefit by replacing it, but the new unit's more efficient, but look, the duct system is also more efficient. And now your saving starts to be a number that you can get your arms around.

DR. AMRANE: I'm not quite sure about that. That's our concern. I don't think that it's really justified that way. Your cost/ benefit -- we can discuss about that --

MR. RAYMER: Bob Raymer with CBIA. Tom Trimberger from CALBO raises two issues. The first, the legal issue and the second the practicality of implementation.

CBIA strongly agrees that the practicality of implementation, that's a significant issue that's going to have to be addressed. And I think it's a nut we can crack.

On the first one on the legality, the sponsor of AB-549, we looked into the issue of what the Energy Commission has the authority to do, and where they're constrained, because this has come up since 1985.

And in our analysis the state housing law that starts at 17922 of the Health and Safety Code, relates to 8CD and has a peripheral reference to the state fire marshal. There's no mention of the Energy Commission whatsoever.

The Energy Commission's authority, this comes from 25402 in the Public Resources Code, says they can do X, Y and Z. There is no restriction. And for good or for bad it seems like the CEC has some rather broad authority in the existing housing stock and existing commercial stock.

The question is how that can be effectively implemented. That is the big issue to us. And just coming up with a standard without considering the reality of the world, that indeed, we're talking probably 15 to 20 percent get permits pulled. There's a huge chunk out there that nobody's looking at.

And so we need to deal with that in a realistic way.

MR. ALCORN: Thank you, Bob. Mike Gabel.

MR. GABEL: I think -- my own company deals with hundreds of builders and contractors and custom homes and tracts and stuff -- I think this is a case where if they made this law, as Mark Modera said, maybe only 10 percent to 50 percent are getting permits anyway. I think the people who want to get a permit could be explained, from our point of view, that this is a cost effective thing. And they would go for it if they understood it's really cost effective. And they'll get the permits.

And the people who are not getting permits now will continue to not get permits. And they will either put in new equipment illegally, or they'll fix their old equipment.

I don't think you're going to affect the behavior significantly of who chooses to do what, except the law would be helpful in explaining to people that it's not only cost effective, it also happens to be the law. And for some people that occasionally makes a difference.

But I don't think it's going to radically change behavior.

MR. TRIMBERGER: We're in a competitive market. If I'm going to be an honest contractor and it's costing me $600 more to sell the system than the other guy, I've got an extreme disincentive to follow the law and to get a permit.

MR. PENNINGTON: One of the suggestions that was made at the last workshop when we were talking about windows was that perhaps the Energy Commission should be working with the contractors state licensing board to communicate to that agency and to contractors that there is an expectation here for them.

And I think that something like that would be a viable way to try to address the concern.

MR. RAYMER: Absolutely, Bill, if it's a requirement under the title 24 part 6, if they don't follow it they're at risk of their license being revoked.

MR. TRIMBERGER: I deal with CSLD on a monthly basis. And I sic them on contractors that do things wrong. And I'll tell you that they're very limited to their enforceability and what they can do to contractors.

MR. STONE: Nehemiah Stone of Heschong Mahone Group.

MR. PENNINGTON: Just a second, Nehemiah.

I agree with you, and that's been my experience, too. That trying to, you know, enforce a complaint against a contractor is a real uphill battle kind of thing.

But on the other hand, if there was a willingness on the contractors state licensing board to communicate with contractors, that this is really their legal responsibility. That would have a deterrent effect, you know, to contractors just ignoring this.

And it could, you know, conceivably increase the number of contractors that would actually participate.

I mean I'm not sure who mentioned it at the last meeting, but you know, contractors pay attention to the list of contractors that some action is being taken against them related to their license, and that's a significant piece of information for contractors to be getting regularly, you know, about problems with contractors.

I'm not saying this is perfect, but --

MR. TRIMBERGER: Yeah, I didn't mean to say don't do it. It's definitely, you know, do everything. But to expect much out of that is grasping at straws. They're already overworked, and they're under-funded to do what they're doing. And now you're going to add a new problem on them. And to try to get them to enforce this, as well as everything they've been doing, it may be grasping at straws is all.

MR. ALCORN: Nehemiah.

MR. STONE: Speaking as somebody who's been on both sides of that, having been a contractor and having been chief building inspector, there's a certain number of contractors that aren't going to get permits no matter what. You know, and I know that in the jurisdiction I was in, there was a large number that would basically do a simple cost effective analysis. My permit fee's going to be doubled if I get caught not having pulled one. How many times can I not get caught and have it be cost effective.

And so, you know, they're not -- certain contractors are just not going to pull them. And there's not much you can do.

But like any other industry, this is something that increases the value of what that contractor is selling. And if the contractor is only selling it on the fact that I'm going to charge you 600 bucks more, period, then yeah, the customer is going to go down the street to somebody who's not going to pull a permit, not going to have to work on the ducts, and therefore charge less.

The smarter contractors and typically those are the ones that are more successful, don't sell on price. They sell on value and quality. And this is something that increases the value and the quality of what's being delivered. And those contractors will go out and get the permits. They will put in the ducts because they understand, you know, they will understand that it makes for a better product; it makes for fewer callbacks; and the equipment that they're selling is going to work better.

You're not going to make any effect on the other ones. There's nothing you can do about that.

MR. ALCORN: Okay, any other final comments before we head off to lunch.

We have about 20 minutes. We're going to reconvene at 1:15.

(Whereupon, at 12:53 p.m., the workshop was adjourned, to reconvene at 1:15 p.m., this same day.)

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AFTERNOON SESSION

1:31 p.m.

MR. ALCORN: Okay, may I have your attention, please. We're going to start on the second half. The first presentation is going to be on the water heating in multifamily measure report. And Nehemiah Stone is making the presentation.

MR. STONE: Good afternoon. Nehemiah Stone with Heschong Mahone Group for Pacific Gas and Electric.

The multifamily domestic water heating proposal is essentially two proposals. And I want to talk about the two separately at the beginning, and then they kind of meld together in the end of this discussion.

The two proposals are to create -- proposal one is to create a central water heating budget that is separate from water heating budgets for individual water heaters in every apartment.

The second half of the proposal is to create multipliers for what makes a difference in the distribution system of the central water heater, part of which are controls, but then there's other things.

So, currently in the water heating budget the allowable water heating energy is calculated assuming a 50 gallon minimum efficient water heater in each and every residential unit.

What our proposal is is to compare like to like. If you have individual water heaters in every unit, then that's what your budget is based on. If you have a central water heater that serves multiple units, then that is what your budget is based upon.

In terms of the distribution system multipliers, currently pipe losses are under estimated in the ACMs. And we are looking at what that difference is, and including that in the ACM in the future.

Currently the only control that receives credit is the temperature control, essentially an aquastat. And we're proposing that there be credits for different kinds of controls, and there be credits for increased insulation levels and other things that affect the distribution losses.

I'd like to show why it is important that we deal with the distribution losses differently than we have in the past. When you take a look at the three prototype buildings that we modeled -- we had 29 buildings that we selected these from, and these are reasonably typical of three different kinds of multifamily buildings that you'll find.

As a percentage of the total building energy use, distribution losses, depending upon the style of your building, can approach 25 percent. So one-quarter of all the energy being used by these buildings could be simply a matter of distribution losses for the central water heating system.

The ACM doesn't currently pick that up. And so it looks like you have this great energy efficiency item just by having a central water heater.

As a percentage of DHW energy use, it approaches 40 percent of the energy in distribution losses.

Next slide. What this results in is that a number of things that would normally be required in prescriptive approach are lost; they're traded away because of this huge loophole.

Now, there are two loopholes. The other one was discussed this morning, and that's fenestration area. In the analysis we did here we neutralized fenestration area. We assumed that these buildings had maximum fenestration area in it.

And a couple things jump out here, and one is that for the smaller apartments you are down at the absolute mandatory minimum of insulation levels.

The other thing we did here was to show that if you have an HVAC system with ducts, then the other things that would be traded away is, you know, ducts don't have to be sealed; TXVs aren't required. If you have a different kind of heating system that chart isn't shown here, but essentially you go down to single glazed aluminum windows in most cases.

The next slide shows the form of what the new equation would be if we weren't going to an hourly model. And I say that because the next presentation after mine is proposing that water heating go to an hourly model. We support that. But what we wanted to do here was show a similarity to what the existing system is, and how it would work.

The difference is that between what's currently in the standards and this is that there are different factors than what's in the standards, different constants than are currently what's in the standards for multifamily than single family.

And those constants vary by climate zone enough that we believe that -- the impact varies by climate zone enough that we believe the constant should vary by impact.

Next slide. Once the Commission decides on going to an hourly model, it's relatively simple to take what we have done and develop the multipliers for that hourly model. The analysis is already done -- mostly done. It's simply a matter of figuring out what the multipliers are at that point, and which ones need to be applied how within which hours.

The same assumptions, it would require the same assumptions for the budget, and that is that there's a minimum efficient boiler; there is a recirculation loop; there's a control on that loop; and the simplest control is a nighttime shutoff control, time control. Minimum insulation, in other words insulation that complies with table 1T; and that 95 percent of the loop is within the envelope.

The amount of the distribution loop that is outside the envelope obviously can vary quite a bit. We believe that in most cases you have about 95 percent of it in. The location of the piping makes a big difference. And that's why we believe it's one of the assumptions that ought to be up front.

The methodology we used was to first examine a number of different multifamily buildings; select our prototypical buildings. And the three we selected, a relatively small multifamily building; it's a low rise, 40 unit apartment building.

The next one was a relatively large, six story, 100-plus units. And then the last one was a campus style, and actually was on the campus of UC Davis, representing a central water heater with a distributed system, much of which is underground.

Davis Energy Group then developed the hourly hot water loads for us based on the same analysis tool and the same essential assumptions that were used for the 90/92 analysis, and were also used for their single family distribution loss analysis for this proceeding.

We then developed UAs and distribution piping lengths based off the plans for the three prototypes. And then we used a DOE2.2 model to analyze the impact of the changes and the differences between one building and another.

We used 2.2 because that allows us to have a distribution model and see what the impact is of changes to the distribution system, whereas 2.1 doesn't give you that ability.

Again, our basecase was minimums per the standards. In other words, we used the building designs as they were, but we put everything for the system at the minimums required by the standards.

Where it says reasonable assumptions, again that's, you know, the biggest one there was the 95 percent of the piping is inside the envelope.

Now, for all three of these buildings it was something slightly different than that. Well, for one it was slightly different; for one it was, you know, somewhat different; and for the third one it was significantly different. There was about 80 percent of the piping in the campus design that was outside the envelope. So making that change was a big change from what was in the plans, but then it allowed us to see how much different it makes to have piping underground or outside.

I think we can skip this one, I already went over those issues.

Distribution measures analyzed. In addition to coming up with what the central water heating budget would be, what we looked at was what effects the distribution system that ought to be included as switches within an ACM.

So we looked at increasing pipe insulation; we looked at changing the location of the piping, and we did that with underground, ambient or inside-the-envelope. We did it by changing the percentages, 100 percent inside the envelope; 95 percent inside; 20 percent inside; 80 percent inside; and 100 percent inside.

We looked at time controls; we looked at three different patterns for the time control. Nighttime shutoff; peak hour shutoff; and nighttime plus peak hour shutoff. We're not recommending to include peak because a) it's not a sure thing that it will be used; and b) the energy impact is actually fairly small and so not a lot is lost by ignoring it.

We looked at having a research system with no controls. We looked at having a central water heating system with no recirc. And we looked at having separate laundry center and what impact that would have on the water heating energy use.

We have some measures still to be analyzed. In our original proposal we were going to also look at temperature controls; time temperature controls; demand controls. Because of some problems that we ran into in the modeling, we were not able to look at temperature controls yet. We will be doing that next month.

And demand control, we assumed from not being able to find it in any examples, that it was inappropriate to include demand control for multifamily.

We have since seen an example where it's actually probably a very good control. And we, it looks like, are going to get some funding from another source to include a demand control. It doesn't work exactly like the single family where you push a button, but rather it's actuated by a sensor that senses a change in the water pressure just outside the boiler. And then shuts off based on a temperature control at the beginning of the recirc loop.

So, we will probably be able to come back with a recommendation on demand controls, also.

I see that I included the same graph twice, so I will ignore that. That's the end of the presentation, and I'll take questions.

MR. ALCORN: Thank you, Nehemiah. Ahmed.

MR. AHMED: Nehemiah, can you explain to me on a couple of things from your presentation here. I'm not very sure.

Basically,

MR. STONE: Where are we looking?

MR. AHMED: On the third slide, distribution losses slide. When they say project numbers 2, 11, 13, are these assuming different types of distribution loops, or is it just different projects?

MR. STONE: They're different apartment buildings. The distribution loops in each of those apartment buildings was designed by the mechanical engineer for that building, to meet the loads within that building.

So, in other words, one of them goes up to 2.5 inch piping. Another one only goes up to 1.75 inch piping.

MR. AHMED: So you can't really categorize these losses as related to the loss controls or the distance of the pipe, or that they're in the ambient conditions, or they are underground, or they are within the envelope?

MR. STONE: In these cases, as I said, we've neutralized those items. The distribution system that was designed is in that model, but in all cases we have put the minimum insulation required by the mandatory measures in there, we have put a demand control -- excuse me, a time control that shuts it off for seven hours at night.

And we have used the same, essentially the same draw schedule. Davis Energy Group created a draw schedule for each size apartment. And the apartments in these three projects are of different sizes. And so you will see somewhat different draw schedules for them.

But it all comes back to the exact same draws of hot water per square foot that was part of the base assumption for the 1990 analysis; and for Davis Energy's single family analysis.

MR. AHMED: Going to the next slide, I do not understand this slide. Basically is the budget number on the bottom? The assigned budget for that particular square footage, and for what climate zone is it?

MR. STONE: I'm sorry, I didn't list the climate zone. I apologize for that. This is all for climate zone 12.

Actually, Ahmed, currently the DHW budget does not change by climate zone. It doesn't matter what climate zone you're in, you have the same DHW budget.

We're proposing that it change by climate zone.

MR. AHMED: So this was calculated based on your proposal or based on current?

MR. STONE: This is based on the current. This is showing the reason why we did what we did. Currently this is how your budget changes. Take a look at that bottom row.

MR. AHMED: Right.

MR. STONE: This is how your budget changes depending upon what the size of your apartment is. And with those different budgets, and you look up above and you see what measures, what you have to put in to have, to comply with the overall building budget.

MR. AHMED: What I was wondering is maybe you could have shown us the difference between actual energy consumption, if it is on a central system, versus the sum of the individual budgets. To show how big a loophole it is that you are -- because you're saying --

MR. STONE: Can you restate that? I didn't understand. Can you restate that?

MR. AHMED: Because the assumption is that in multifamily buildings with central water heaters there's a big discrepancy between the actual budget versus what the central water heater uses. And therefore, that could be traded off.

And if you'd have shown us this, then we would have understood the big difference. In other words, with a central water heating system what is the budget, and then what would be the -- I mean what is the consumption versus the budget, itself. Just to see the difference between the two. That would help.

MR. STONE: Well, it might have helped

slightly. And the reason I say that is because to analyze what the consumption is currently -- to currently analyze what the consumption is, you have to use DOE2.1, which doesn't model the distribution losses.

So it ends up saying that it's using a whole lot less energy than the building actually would. It doesn't correctly model the distribution loses.

Now, if you go to the report and you take a look at the tables in one of the first two appendices, you'll see that we do list there what the energy use is for the building, using 2.2, which much more correctly models the distribution losses.

What I tried to show with this table is assuming that you want to design this multifamily building so it just barely complies, what do we lose.

Well, you know, if you take a look at this column under prescriptive you see what would have been required. And you take a look at the next column over, if these were 700 square foot apartments, what is required.

So it's a different way of saying the

same thing that you're trying to get at.

MR. AHMED: Now, in these real projects that you looked into, what did these projects show? Did they show that they have sacrificed, you know, other measures by installing a central water heating system?

We always wondered whether or not this tradeoff is really happening out there. What evidence is there. We know that it does exist, but is there any statistical data or field data to suggest that it is happening?

MR. STONE: Actually, we're involved in a study right now that PG&E has funded with RER to get exactly that information.

MR. AHMED: Okay.

MR. STONE: What are people showing in their compliance documentation and how are they actually building, and how does this compare to what the standards require. So we'll be able to answer that question when that study is done.

MR. AHMED: When is --

MR. STONE: At this point I can give you some anecdotes. And I can tell you that in working with SDG&E on their multifamily program, and then working with Edison on their multifamily program, that most multifamily buildings are designed initially to be within about 10, 15 percent of the standards.

And with that they have traded off ceiling insulation; they've traded off window performance, et cetera. You just bring them up to the prescriptive, you leave the water heating system that they're putting into it in it. You bring them up to the prescriptive level on everything else. And they're 20 to 40 percent better than the standards.

MR. ALCORN: Bill, did you have a --

MR. PENNINGTON: I was just going to say, Ahmed, that the Commission did a little contract to look at compliance documentation for multifamily and found that. In fact there's a report, we could get you the report.

MR. AHMED: That'll help.

MR. ALCORN: Ken.

MR. NITTLER: Ken Nittler with Enercomp. On slide number five, Nehemiah, where it has the equation 1-0, wearing my hat that says software vendor, the software presently doesn't actually track or know these sub-x values.

And I'm wondering could this equation be modified so that it's the average floor area for average dwelling unit size, rather than a specific unit size?

MR. PENNINGTON: We can probably make a table, if you like tables. Sorry.

MR. STONE: Let me give you two answers to that. First answer is this equation is an example only, to show that we can put this into the same format that is currently in the standards. I say that because this is not what we're going to end up with. We're going to end up with an hourly model. And therefore, we're going to end up with a whole different equation.

Secondly, we have taken a look at that, Ken. Do you end up with the same number if you use average versus adding up what you get for each different size of apartment. And the answer is no, you don't. You end up with a different number. It's within 5 or 10 percent. And since this only gets you within 5 or 10 percent, in other words, when did the regression for the two constants, C and Y, we are only -- there are variations of 5 to 10 percent.

So, maybe it doesn't matter that the other one's only going to get you within 5 to 10 percent of that. But, in point of fact, this equation is not what -- we don't think this equation's what's going to be used, anyway, because we believe that the hourly model is going to be what's adopted.

MR. NITTLER: Okay, well, it would be a major increase in complexity to track each individual dwelling unit in a multifamily building. It's not being used on any of the other measures in the standard, and I would strongly recommend that we don't do it here.

MR. STONE: From the projects we've looked at, the maximum number of different sizes of apartments that I can remember out of any of those projects, was five.

In other words, you'd be tracking five different sizes of apartments, and how many apartments there were of each size. That would add too much complexity?

MR. NITTLER: Yep.

MR. STONE: Would you go for four? Never mind.

(Laughter.)

MR. ALCORN: Okay, if Ken's done. Misti Bruceri.

MS. BRUCERI: Misti Bruceri with PG&E. And I just want to address Ahmed's question. I recently done a plan check for about 100 buildings in PG&E's multifamily program, the most recent program. And we see, I'd say, between 80 to 90 percent of the time, these multifamily buildings are reaching 15 percent beyond the compliance without doing anything extraordinary, often with standard efficiency equipment and just oftentimes really just improving the windows.

So, yeah, those tradeoffs are being made very regularly.

MR. ALCORN: Thank you, Misti. Mike Gabel.

MR. GABEL: Mike Gabel, now I'm representing CABEC officially this afternoon.

Let me applaud, first, the Commission and the staff for -- and HMG for doing this work. I think it's been long overdue. I think CABEC first brought this to the attention of the Commission about seven or eight years ago. We've been concerned about it, so we're happy to see this being resolved.

Nehemiah, I just have a quick couple of questions for you. I want to make sure I understand this correctly, that any building which has individual water heaters will be compared in the standard building to individual water heaters for domestic hot water?

MR. STONE: Correct.

MR. GABEL: Okay. That's good. The philosophical question I'm raising, I don't have the answer, or I don't think there is a right answer, but the question of what's a credit and what's a penalty and what's neutral in these options. The question's whether recirculating loop should be considered the default, or whether if somebody for some reason in this small apartment building with a central boiler, if they don't have a recirc pump, maybe we should compare them to the same system without a recirc pump.

I think the staff needs to consider carefully when you want to give credits and penalties. And maybe you have done that already, and maybe you've reached those conclusions. I just want to --

MR. STONE: Can I address that one before you go on?

MR. GABEL: Yeah.

MR. STONE: We actually did consider

that. Whether the standard ought to be a central system without a recirc pump.

And the reason we rejected it, Mike, is because there is an issue of tenant satisfaction. And if it takes too long for the hot water to get out there, then what's going to happen is the building's going to get retrofit to add a pump.

MR. GABEL: Yeah, actually I was saying something different. I'm saying if you don't have a recirc pump, the standard design doesn't have it. If you have one, the standard design does have it.

MR. STONE: No, we're saying the same thing.

MR. GABEL: Oh, okay, wanted to make sure.

MR. STONE: So, you don't have a recirc pump, you compare it to a building that doesn't have a recirc pump. Six months later it's got a recirc pump because the tenants are pissed.

MR. GABEL: I see, okay.

MR. STONE: In fact, you know, that can make a difference of 15 to 19 percent on the DHW energy, just pretending that there's not going to be a pump in --

MR. GABEL: Good. Sounds like you thought it through.

MR. STONE: Yeah.

MR. GABEL: Excellent. I just wanted to know your thinking about that.

The reality check of the simulations versus some kind of real world performance data, you guys are satisfied that in a range of building types and sizes that stuff tracks in the right logarithmic ballpark of what the models are predicting for water usage?

MR. STONE: Yeah.

(Laughter.)

MR. STONE: I don't know exactly how to answer that, Mike. I mean I take a look at a lot of things in the standards -- Charles and I were having this discussion earlier -- there's an awful lot of things in the standards where we assume something that we have to assume because, you know, you can't take an average.

I mean, for example, back in '92 Bruce did some research on well, how do people operate their thermostats. And found there was four different patterns. Some people don't operate them at all, you know, their equipment is only on, you know, three days out of the year. Some people operate it like a gas pedal, you know; if they're too hot, they turn on the air conditioner; if they're too cold, they turn on the heater. Some people operate it like we expect.

How do you take an average of those? And we end up with the same thing here.

MR. GABEL: Right, I know it's a loaded question because there's no way, really, to --

MR. STONE: I'm satisfied that the method we've used, the regression analysis that we used to get the two constants in this equation, gives us the best answer we can for those constants.

I'm not uncomfortable, because I feel like we've solved 60 to 70 percent of the error in water heating. Am I comfortable that we're done with the job? Not at all.

MR. GABEL: Okay.

MR. ALCORN: Perhaps the person at the podium has an answer.

MR. LUTZ: Yeah -- no.

(Laughter.)

MR. LUTZ: I don't have an answer. This is Jim Lutz from LBL. And I think what you were asking is how does this compare to the real world data on how people use hot water.

MR. GABEL: In a simple sense, yeah.

MR. LUTZ: And the answer is nobody really knows. There's very very limited data on it. There's probably actually more on multifamily data on hot water use patterns from the system, not out at the individual units.

But on single family I think the data, real life data from California houses is limited to probably ten that PG&E did as part of EPRI study in the early '80s. And that's it. And that was before the low flow standards came in.

So the answer is he's probably done the best he can without that data. And that data is sorely lacking.

MR. GABEL: Okay, I mean I think CABEC would like to see, you know, long-term commitment by the Commission, as it always has generally articulated that over the long haul, 2008, 2011, we try to get some data.

I mean just because in mild climate zones water heating is such a huge part of the energy budget. And that, you know, it can make such an enormous difference in energy measures, and every other energy measure, even in the standards.

And I applaud you guys for doing the best you could. Just looking at it in terms of funding some projects, which would let us tune this in the future, that's what we'd like to see.

MR. STONE: Michael, can I ask that you take a look at the last appendix in this report, and have your members take a look at it, and give us feedback. The last appendix of this report is recommendations for future research, so that we can handle the last 30 to 40 percent that we can't get at this point.

MR. GABEL: Okay, great. And then indulge me one more question about DOE2.2 versus 2.1E. The new ACMs are going to have 2.1E in it probably. So the question is what's the discrepancy in terms of the signals it sends, somewhat inaccurately as compared to what you all believe is a better model, which is 2.2.

But the other area is EnergyPlus going to have a better model than DOE2.1E in this area?

MR. STONE: Well, again, using this for the research was because this allowed -- 2.2 allows us to take a look at impacts on the distribution system. It doesn't predispose the Commission to using 2.2 or 2.1 or EnergyPlus or anything else.

Once we've done this work, we develop the multipliers, those multipliers can be applied within MICROPAS or 2.1, doesn't matter.

MR. GABEL: Okay. So the multiplier is the solution to not having the ACMs model this explicitly, essentially. Okay, thank you.

MR. ALCORN: You're welcome, Michael, thanks. Ahmed.

MR. AHMED: I just want to understand this between Charles and Nehemiah. Is Nehemiah's work going to produce the budget, and Charles' work will distribute it on an hourly basis? Is that basically what is going to happen?

MR. ELEY: -- yes.

MR. AHMED: So the DOE2.2 will be used to establish the budget for central system versus individual system?

MR. STONE: I'm not sure I understand the question.

MR. ELEY: Well, I think your question will be answered under the next presentation, if you can just hang on for a few minutes.

MR. STONE: I will tell you that Eley, HMG and Davis Energy Group plan to work very closely together in this next phase, because Davis Energy Group has done work on distribution changes for single family. We've done work on distribution changes for single family and for central water heating. And Charles is doing work on an hourly model.

So, we obviously will be working very closely together. As to exactly, you know, what the job descriptions look like within that, I can't --

MR. AHMED: The reason I ask this question is because for a single family we know the budget and the way Charles made his presentation last time was that you take this budget and spread it over the hours.

But for multifamily the budget is based on individual water heaters right now. And so you have to come up with a new central water heating budget. That will probably have to be distributed on an hourly basis or something like that.

And I want to understand if that's what's going to be done.

MR. ELEY: Next presentation will

address that.

MR. AHMED: Okay. And then the other question I have, Nehemiah, regarding your climate zone constants, that's basically were developed from the simulation runs, right? And through regression analysis?

MR. STONE: Yes.

MR. AHMED: In other words, you do not know how these constants have been generated exactly. What is really behind these constants. Is basically only through the statistical analysis you came up with these numbers, is that what it is?

MR. STONE: I wouldn't say we don't know what's behind them. Unless I'm misunderstanding your question. We did thousands of DOE2 runs.

MR. AHMED: Right.

MR. STONE: We looked at a number of building configurations within these three buildings. We changes numbers of apartments and sizes of apartments. We changed where the piping is, and we changed all these measures.

And we took a look at, in order to get the best fit for this equation, we wanted to match the equation that's currently being used. And what you see in the standards is kind of a subset of this.

MR. ALCORN: Right.

MR. STONE: But what you see in the ACM is this. This is essentially it. This is not much different except that this says that the constants vary by climate zone.

So matching that equation, that form of the equation, we came up with the best fit of C and Y.

MR. AHMED: So if the distribution system changes, does it change the constant?

MR. STONE: Not for the budget. It will for the use. Not for the budget. The budget is based on these set assumptions.

MR. AHMED: Okay.

MR. STONE: You've got 95 percent of the piping in the envelope, et cetera.

MR. AHMED: Okay, I got it.

MR. STONE: So the budget is fixed with those assumptions. The proposed would change as you change the distribution system, et cetera.

MR. AHMED: Okay.

MR. ALCORN: Are there any further questions or comments on this water heating and multifamily report?

MR. AHMED: Can I make one last comment?

MR. ALCORN: Sure, you bet.

MR. AHMED: I was wondering, Bill, if there's going to be another workshop after further work's done on this issue? Or are you going straight to some sort of language?

MR. PENNINGTON: The latter.

MR. AHMED: So will we be able to see some interim reports?

MR. PENNINGTON: I don't expect that.

MR. AHMED: So if we have --

MR. PENNINGTON: End of the summer I expect to have a draft proposal here. You want to comment on that?

MR. ELEY: I agree, but there will be plenty of time, plenty more opportunities to comment.

MR. AHMED: Okay.

MR. ALCORN: Okay, thank you, Nehemiah. The next topic is hourly water heating calculations that Charles was referring to a few minutes ago. And Charles will be making the presentation.

MR. ELEY: I guess this is the only one

I need. Next slide, please. Back up one, you went two slides.

There's several reasons that the hourly calculations are being proposed. The first one is just simplicity. Assuming that we have to move to an hourly method because of TDV, what's being recommended here is a lot simpler than using the equations that we now have for the water heating budget.

While the equation works okay for annual energy calculations, but the only way it could work with TDV is if you had a separate equation or separate set of equation coefficients for every climate zone, every fuel type, gas, propane, electricity, and for each standard design situation, central system versus individual, or recirc, no recirc.

So, what we're really recommending here is an approach just like we've been using for space conditioning where we have a calculation method, we define the standard design and so it's really a custom budget approach.

Another benefit is consistency. When the same calculation procedure is used to calculate both the energy budget and the energy of the proposed design, then there's inherently more consistency.

The next benefit is accuracy. The method is more accurate, especially with regard to distribution systems. And this is related to another code change that was presented on April 23rd, I think it was.

And then another part of this proposal is that it closes loopholes by defining the custom budget -- by defining the standard design differently for systems that serve multiple dwelling units.

The hourly method also enables us to assess the impact on peak loads, or peak electricity. This would be an issue where electric water heaters are being considered.

And, finally, it works with the proposal for time depending valuation.

Next slide, please. There's really three other proposals that are related to this. In a way you can think of this proposal as kind of the glue that's pulling together three other research efforts.

One of them you just heard about, which is Nehemiah's work on multifamily. The other one is time dependent valuation, which is a complex project that's been going on for a couple years. But I think now reaching conclusion, hopefully.

And the third code related research effort was presented on April 23rd, and that's the work by Davis Energy Group to develop -- to improve the water heating distribution system multipliers. So this proposal is kind of pulling all those things together.

Next slide, please. The goals here are four. We want this method to be consistent with and implement TDV. We want it to be consistent with current modeling assumptions. We're not proposing to change the fundamental way that water heating is done now.

We want it to accommodate different definitions of the standard design. And mainly what we're talking about here is the differentiation between systems that serve multiple units versus systems that serve individual units.

And finally, it should implement the distribution loss changes that are being proposed.

Next slide, please. There's three steps kind of in the process here. The first is to modify the load dependent energy factor calculations to work on an hourly basis.

Next, we need to modify the calculation procedures so that we can come up with an hourly adjusted recovery load. I'll come back to that one in a minute.

And this requires coming up with an hourly schedule of hot water use that's consistent with current modeling assumptions. And defining other inputs, such as the inlet temperature and the supply temperature.

And finally, we need to define the standard design which is largely done through the work that Nehemiah just presented.

Next slide, please. A key aspect of the Energy Commission's water heating methodology is something called the load dependent energy factor. This was developed in the early '90s to deal with the impact of load on the water heater.

The idea is that with low loads the standby component is a larger fraction of energy use, and this will drive down the efficiency of the unit. And the other side of that is that higher loads, the standby component is a smaller fraction of energy use, and the average efficiency or the overall efficiency goes up.

So what this graph shows is how the vertical axis is the ratio of the load dependent energy factor to the energy factor. And this line right here is 1.

So with these calculations, when the average daily consumption is about 58 gallons per day, the load dependent energy factor equals the energy factor. When the consumption goes above 58 gallons a day, the load dependent energy factor is actually better than the energy factor. And then when the consumption is lower it works the other way.

So this is what we've got now. This is the equation that's implemented in the water heating calculations. There's a number of assumptions that I had to make to develop this graph. The inlet temperature was assumed to be 55; the outlet 120. The energy factor was assumed to be .58, which is about what's going to be required in 2004. And it's also a system that's commonly used today, because when you're 58 or greater you can avoid the water heater jacket, and so that's one of the reasons that we use that number.

Next slide, please. This gets kind of nerdy, but if you can bear with me a moment here, the equation one is the equation for the load dependent energy factor. So there's two independent terms in this equation. One of them is the energy factor, the EF term. And the other one is the adjusted recovery load, the ARL.

So, this term inside the brackets there, after the natural log, is the term that needs to be modified in order to convert it to an hourly method. And so the equivalent, shown down here, if you take that term that's equal to the hourly adjusted recovery load times 24, divided by 1000. That brings it all into the same units.

And then that same equation can then be used for the water heating consumption at a given hour. So that's the basic change here. And the equation 4 at the bottom just basically substituting those terms and coming up with the modified equation.

Now, this load dependent energy factor is used for all NAECA water heaters, all gas, electric, all NAECA water heaters that are rated with an energy factor, this is what's used.

For non NAECA equipment, this is larger

equipment, there's another calculation procedure in the ACM manual that does not need to be modified. It already works for an hourly calculation. So there's no need to change that one at all.

Next slide, please. Okay, let's return to the term for adjusted recovery load. Equation 5 gives the adjusted recovery load, and it's basically equal to the standard recovery load times a distribution system multiplier.

For the standard distribution system that multiplier is 1. And for equipment, for recirculating systems it's a number larger than 1. And if you have parallel piping, you know, it's a number lower than 1. And so forth. That's the way we now deal with distribution systems and there's some minor change to that, but it's pretty straightforward.

The second equation 6 shows how the standard recovery load is now calculated. It's not based on engineering; it's just his equation, this regression equation. So the recovery load, the standard recovery load actually scales with house size.

As you can see, CFA or conditioned floor area is one of the independent terms there. But it's capped at 2500 square feet as a matter of policy. So, if you get above 2500 square feet, your standard recovery load does not get any larger.

Now, the standard recovery load has built into it a distribution loss of 22 percent. So that standard recovery load already includes pipe losses from the standard system.

Next slide. One more and then we'll be through the nerdy stuff. Okay, this is what we're proposing to do. Equation 7 would be the equation that we're going to use for the thermal loads at the water heater for each hour. So that would be equal to the HSEU, the standard -- forgot what that stands for -- water heating energy use or something -- times the distribution loss multiplier.

Now, equation 8 shows how the HSEU would be calculated, and this now just comes down to engineering. You multiply the gallons of consumption for that hour times 8.3. 8.3 is the heat required to lift a gallon of water one degree Fahrenheit, times the delta T. And so it's a real straightforward calculation, and that's what's being proposed.

Equations 9, 10 and 11 were presented previously at the April 23rd workshop, and these are the equations for calculating the distribution loss multipliers for the standard design and also for the proposed design. I won't go through those in great detail here, in the interest of time.

Next slide, please. These are the load dependent energy factor coefficients. There's no need to change these. As long as you change that term in the brackets after the natural law, the coefficients can remain as they are.

Next slide, please. Again, this is taking material that was already presented at the April 23rd workshop, but this shows the distribution loss system multipliers. There's three columns of numbers, and you probably can't read this -- slide is a little better.

The rows of this table are the different types of distribution systems that are recognized. And the first two columns of numbers are both for systems serving individual dwelling units.

And there's still an option, I guess, on the table about whether piping to the kitchen will be required to be insulated or not, so the column labeled mandatory kitchen pipe insulation assumes that that pipe would be insulated, and the multipliers are based on that assumption.

The next column assumes that the kitchen piping would not be insulated and the multipliers are based on that assumptions. So whichever way we go here, the multipliers are presented.

The third column is for multifamily. We've got a -- we're still waiting to get those numbers. Those will come, hopefully, from Nehemiah's work on multifamily, or from one of the followup projects.

Next slide, please. Okay, now if you go back to that equation for standard recovery load that had conditioned floor area as an independent term, you can solve that equation for gallons per day of hot water consumption. And that's what's happening here in this figure.

The bottomline is that what we're now assuming in the standard is a constant 24 gallons a day, plus another 16 gallons per day for each 1000 square foot of floor area. Again, up to a maximum of 2500 square feet.

So, the equation at the top where it says gallons per day equals 24 times .016 cfa, that's what's being graphed there.

So, basically the maximum consumption in any dwelling unit would be capped at about 65 gallons according to this, and that's basically what's built into the current water heating methodology.

Next slide, please. That standard recovery load equation is based on a constant lift of 65 degrees Fahrenheit, which could be assumed to be inlet temperature of 55 and a supply of 120. And in the current method that does not change by climate zone or by month of the year or anything like that.

And if we want to be completely consistent with the existing water heating methodology, we would just declare a 65 degree lift as a standard assumption.

However, we could improve the accuracy of the method and provide some variation by climate by adopting a table like this, or adopting the algorithms that underlie this table.

These data show the average ground temperature for each climate zone, and for each month of the year. And these data are being proposed now for the improved slab loss model that was presented on April 2nd, I believe. And if we want to, we could substitute this table of numbers, or the underlying algorithms to make the method sensitive to climate and to the month of the year.

This would increase water heating consumption in the winter and reduce it in the summer. And all of the consumption data indicates that this really is the case. So, it would probably be a good thing to do.

Next slide. The next thing we need to do with this method is adopt an hourly schedule of hot water consumption. The approach that we took here was to collect data from as many sources as possible, to analyze these, and then to recommend an hourly schedule.

Nehemiah did a lot of the leg work for us on this. He looked at, I guess there were a couple of reports that had hourly consumption for multifamily. Golders one of them, and Perlman was another. We also looked at a research paper that Jim Lutz did where he took some data that had been generated by EPRI study, and came up with a model. That was kind of blocky, like this.

And the source of data that you see

plotted here, and the data that we're recommending be used is actually from an appliance metering project that PG&E conducted. And so you can see the pattern of energy use.

There's two curves here based on weekdays and weekends. We would recommend that there be two schedules. If this is too much of a problem, maybe you can average these and make one schedule.

But on weekdays -- the spike is in the morning in both cases, as we all know, but on weekdays that spike is peakier and it happens a little earlier in the day. On weekends the spike is a little flatter and it happens a couple of hours later in the day. That's because we all like to sleep later on weekends, I guess.

Next slide. And then finally we need to define the standard water heating system for both systems serving multiple dwelling units and systems serving individual dwelling units. And Nehemiah has already covered this, basically for multifamily -- not multifamily, systems serving more than one dwelling unit.

The base system would be a central recirculating water heating system meeting the minimum requirements of the code. The pipes would be insulated because they're already required by the code to be insulated.

Next slide. For systems serving individual dwelling units, the standard design would be basically the same as is defined in he 2001 standard. There would be a gas water heater in minimum compliance with NAECA. And a standard distribution system. That would be the basecase.

MR. ALCORN: You said that would be consistent with the 2001 standards, but actually it would be updated to the 2004 standards.

MR. ELEY: Right. See, one of the benefits of this method is when the energy factor gets increased because of the new appliance standards, we don't have to recalculate the budget equation again. We just plug in the numbers.

So the actual size and energy factor of the standard water heater would vary with the size of the water heater of the proposed building. So if the proposed building had a 40 gallon water heater, the energy factor would be the energy factor, the minimum energy factor for a 40 gallon water heater. If you had a 60 gallon water heater it would be the minimum energy factor for a 60 gallon water heater.

Next slide, please. Okay, now this is my last slide. And what I did here is I looked at a typical 24 hour profile and I just did the calculations so that we can see what's happening.

In terms of total energy use there's not a big difference. If you do this using the hourly method, the number comes out to be about 65,870 Btus. Excuse me, that's with the annual method. With the hourly method it comes out to be 64,608.

But what's interesting about this is that at night when the water heater is essentially sitting in standby mode, the load dependent energy factor drops down to about .3. And then during the day, or in the morning when the water heater has got a big load, the load dependent energy factor goes higher than the energy factor. And that's what we would expect to happen.

So, this just kind of validates that we weren't getting real wacky results through this calculation procedure.

So, that's it, Bryan. Thank you.

MR. ALCORN: Okay, thank you, Charles. Any questions or comments for Charles and this report?

MR. AHMED: I have one quick question.
MR. ALCORN: Okay, Ahmed.
MR. AHMED: Charles, if you subtract the two numbers, the hourly adjusted recovery load and the water heating energy use, will you get the distribution loss?
MR. ELEY: I'm going to have to make the slide bigger so I can read it. No, no, the first column of this -- can you bring that slide back up? It's the very last one.
The first column is simply the hour of the day, 1 through 24. And then the second column is the hourly schedule, which sums to 1, so that's taking your daily hot water consumption and spreading it over the day.
The third column is a calculation of the hourly adjusted recovery load, so that's the load that the water heater sees.
And then the fourth column is the calculated load dependent energy factor. And so that gets down as low as .31 and as high as .75, I guess.
And then the last column is the hourly water heating energy use.
MR. AHMED: Right, what I meant if you

were to --

MR. ELEY: It's just dividing those two numbers.

MR. AHMED: Right. What I was wondering was if you take column 3 and column 5, subtract one from the other, would you get the distribution loss plus standby loss?

MR. ELEY: Well, you'd also factored in there would be the efficiency of the water heater and, you know, the recovery efficiency and a lot of other things.

MR. AHMED: Okay. So all the losses would be accounted for if you were to subtract these --

MR. ELEY: Yeah.

MR. AHMED: Okay.

MR. ALCORN: Okay, Ken Nittler.

MR. NITTLER: Ken Nittler with Enercomp. I have a series of questions relating to how you implement this stuff.

First question is, or observation, I guess, is that we're adding the number of stories as a variable here. And occasionally it's not easy to answer that question. People could do a multistory building and end up, for whatever reason, modeling a single dwelling unit within that, and it causes problems because the number of stories specified for water heating might need to be different than the number of stories specified for nighttime venting or something like that. So we need to be careful there.

On heat pump water heaters, if I'm not mistaken the current calculation has a temperature adjustment based on climate zone. Does that get modified by this at all or --

MR. ELEY: No, it will stay exactly the same.

MR. NITTLER: Okay. And then the big one, the same question I threw at Nehemiah. I'd sure like to see the cfa values that are in here specifically be allowed to be the average conditioned floor area for the entire building being modeled.

I don't think the current ACM really says that, but that's the popular interpretation in at least two of the three programs that are implementing it.

MR. ELEY: What was your first question? The stories.

MR. NITTLER: Number of stories.

MR. ELEY: Okay, number of stories is, that's not really a part of this proposal. That was what was presented earlier for distribution losses. And I think that's a legitimate comment, though, but that's -- when Davis presented those numbers on April 23rd, they showed that the losses were different.

I guess the water heating system in two story houses is a bit more compact or something. Fewer pipes.

MR. NITTLER: Well, actually, thinking about this reminds me of something. Maybe this is more for Nehemiah. With some frequency, every few months, I get a call from somebody that's doing central water heating across multiple buildings.

MR. ELEY: That was one of his cases --

MR. NITTLER: Yeah, but --

MR. AHMED: It's like a campus.

MR. NITTLER: Yeah, and calculation-wise it's a challenge, since the buildings are usually modeled separately.

MR. STONE: I was just saying that efficiency-wise it's a challenge because you know, you're running the hot water lines underground, and we believe that the budget ought to be set assuming that you have 95 percent of your piping within the envelope, and so if you do this, you're going to take a huge hit and you're going to have to make it up somewhere else.

Now, in terms of them modeling a building, each of the seven buildings on the campus separately, and then modeling the water heater for the whole thing, if I was a software vendor I'd probably be able to figure that out.

(Laughter.)

SPEAKER: Along with those thousands of people pounding down my doors for that kind of system, I'll add it to my list.

(Laughter.)

MR. STONE: Well, if they can't do it, maybe that's a good reason for them to stop doing it. Doesn't comply with the code, you can't model it.

MR. ALCORN: Okay, is that line of discussion come to a completion there?

Jim Lutz, please.

MR. LUTZ: I have some observations about what Charles did, and they may not be appropriate because it's more observations on how real water heating works compared to how you try to capture it in a code and a standard. So it may not apply.

But, the major observation, especially for single dwelling units, is the hourly hot water schedule that you used is averaged, and so it's moot.

In real use you would want to use a typical pattern not an average pattern because in real use patterns are much much more spikey. You actually aren't drawing hot water for maybe more than an hour a day, whereas you had hot water being drawn all 24 hours of the day.

And that has some consequences. I don't know how big they are, just pointing them out. That you may assume that the distribution loss multiplier is constant. But it isn't really. Because if the hot water isn't being used consistently across the day, the distribution loss multiplier is going to vary depending on the use pattern.

And, again, I'm not sure if this is -- if there's even enough knowledge on how things work in the field to be able to capture these effects, but it's there.

And let's see, and then I guess it

sounds like you're trying to be consistent with the 91 assumptions. Is there any reason to believe the 91 assumptions. And, you know, I'm not sure I'm in a position to say that, but those are observations I have. I'm not sure you want to slow down the changes and the improvements to the code you're making. But it would be nice to try to get some real answers on those.

MR. ELEY: Well, with regard to the 91 assumptions, I think -- we're really trying to implement the hourly method because of TDV. And there's a lot of uncertainty about what the consumption patterns are, and with lack of better knowledge, let's just not change things radically. That's sort of the, I guess, the rationale. Let's not upset the balance between water heating and space heating -- space conditioning that much. Unless you can bring us some hard data.

MR. LUTZ: Oh, I wish.

MR. ELEY: But without that data, I think the idea is to kind of stay with where we are. That's all.

MR. ALCORN: Thank you, Jim. Ahmed.

MR. AHMED: Yeah, I was going to suggest that in setting the multifamily water heating standards we need to look at the different types of buildings, not just have a single project on a per dwelling unit, or whatever, for central systems.

In other words, we should look at smaller complexes like, you know, what you find, eight to ten units, without recirc systems. Larger buildings and the campus type buildings where we do see a lot of centralized water heaters. Because for some reason the builders find it more cost effective to have a central system and pipe the hot water to the individual buildings.

All those categories should be identified and standards set for it. Because we do not want to make it sort of difficult or almost impossible for certain building types or certain system types to comply.

MR. STONE: Can I respond to that just a little bit?

MR. ALCORN: Sure.

MR. STONE: Ahmed, I'm not sure. Are you saying that you think we need to have a different set of assumptions in setting the budget for different kinds of buildings? Or are you saying we ought to take a look at more kinds of buildings than we did in figuring out what assumptions go into setting the budget?

MR. AHMED: The latter, but I would hope that the budgets will be set based on types of buildings, and not just a one type of budget, just single budget for all multifamily buildings. Or just one or two budgets.

In other words, --

MR. STONE: Okay, you just said yes to both my questions, and it was an either/or.

(Laughter.)

MR. STONE: Let me ask it again. Maybe I wasn't clear.

MR. AHMED: Okay, go ahead, ask me again.

MR. STONE: Are you saying that we should set a separate water heating budget for different kinds of buildings, or are you saying we should look at more kinds of buildings in setting the central water heating budget?

MR. AHMED: Different budget for different kinds of buildings.

MR. PENNINGTON: It seems like the building that you're highlighting as a potential problem is the relatively small apartment building, eight to ten units, that wouldn't have a recirc system.

MR. AHMED: That's one. And also the campus type.

MR. PENNINGTON: Well, he's got --

MR. STONE: We used that.

MR. PENNINGTON: -- yeah, they've dealt with the campus type.

MR. STONE: That was one of our three prototypes.

MR. AHMED: But I heard that currently there's no modeling methodology for it.

MR. STONE: No, what you heard was that MICROPAS has a difficulty modeling it.

MR. AHMED: Right.

MR. STONE: That doesn't mean it can't be modeled. It is modeled with other programs. MICROPAS is not the only compliance program.

MR. AHMED: Okay, so you will come up with the budgets, but MICROPAS still can be used for -- will be used for it?

MR. STONE: I can't answer that.

MR. AHMED: Okay, we need to address that, that's what I'm saying.

MR. PENNINGTON: Well, I'm very much disinclined to have, you know, proliferation of budgets here.

And, you know, I've been probably too strongly directive in this manner, but I don't see it, I don't see the value of it. Unless there are really good cases made that it's necessary for some reason.

And I haven't seen a case being made that would show it to be necessary. So I think Nehemiah's work has pretty much concluded that that's the case. That there's not a need for multiple --

MR. ELEY: Individual units and multiple units.

MR. AHMED: Could you repeat that? Which two --

MR. PENNINGTON: I couldn't repeat it.

(Laughter.)

MR. AHMED: Transcript, please.

(Laughter.)

MR. STONE: Let me summarize. The consensus from what we've looked at is that, consensus minus The Gas Company, is that two budgets is enough. One budget for central water heating, one budget for individual water heaters.

Now, in looking at central water heating we didn't just take one building. We took three buildings. One of which was small. It wasn't as small as eight units, but it's 40 units, and, you know, you actually do get very close to replicating the same thing with 40 units as you do with eight.

Another was large, you know, more than 100 units; another was a campus. And so we know how the different changes in the system are going to affect the energy use. We think that it's appropriate to set one budget for anything that has a central water heating system.

And if you don't have a recirc pump in the building, you know, all that means is that the tenants will spend a little less money for their hot water; or the developer, the owner, will spend a little less money for their hot water. It's not going to make enough difference, once you get to a small enough building that it's worth setting a separate budget for that, and risking that people are going to make use of that and then put in a pump because their tenants were unhappy.

If they want to go without a pump that's fine, they can do that. They're going to have to put a few more energy efficiency features in, but we don't risk creating another game when we're trying to close some existing loopholes.

MR. ALCORN: Ahmed, any more questions?

MR. LUTZ: His discussion on different building types brought up that there maybe should be different budgets depending on the occupancy of the building.

It's pretty well documented that seniors use less hot water than everybody -- than other people. And also people who don't pay for their hot water tend to use more than people who do pay for their hot water.

So I don't know if you want to include separate budgets depending on the occupancy type of the building or not.

MR. STONE: We looked at those things, Jim, and in point of fact one of those two, the data is all over the place. And it doesn't necessarily prove the case that people use more hot water if they're not paying for the gas.

In terms of seniors, there is some evidence to that. Again, please take a look at the last appendix in our report, which is the recommended research that needs to be done to be able to answer these questions in a definitive way so that we can get that other 30 to 40 percent of the loophole closed.

But we think at this point there's just not enough information that's specific to California to be able to make those kinds of changes.

MR. ELEY: Well, the other thing is when a building permit is issued, we don't really know who's going to live there. We don't know if it's going to be seniors or a family. So we just have to go with what we know.

MR. PENNINGTON: Or whether it will be a rental at some point --

MR. ELEY: Or a rental, yeah. We may not even know if they pay their own water heating bill. Could be a net lease.

MR. ALCORN: Okay, any more comments on this measure report? Seeing none, let's move on to the next topic, which is lighting controls under skylights. And Jon McHugh will present this report.

MR. McHUGH: Good afternoon. This is Jon McHugh from Heschong Mahone Group, and I'm representing the work done for PG&E as part of our codes and standards enhancements, proposals to the Title 24 standards. And I'm going to be talking about -- next slide, please, six proposals as they relate to skylighting.

Next slide. The first thing I'm going to talk about is the existing daylight zone definition. And currently the daylit zone under a skylight is treated as the footprint of the skylight. That footprint then expanded by one ceiling height's width in all four directions around the skylight.

Next slide, please. And when you do that, what that effectively does is that it sets an effective spacing criterion, which is the spacing distance between the skylights as a ratio to the ceiling height, sets that spacing criterion as 2, which for those of you who are lighting designers, there's not many light fixtures that have that wide a spacing criterion.

So our initial estimate was that this was probably a little extreme for maintaining uniformity of light. And therefore, the lighting that's controlled in the daylit zone, if we just controlled lights with that large of a daylit zone, we'd have non uniformity of lighting in our space.

Next slide, please. So, we looked at the concept of the spacing criterion. It's used in the electric lighting industry for providing appropriate spacing of light fixtures. It tends to be a conservative format that actually other criteria often indicates if you space light fixtures closer together and luckily, the California Energy Commission had sponsored us through the Public Interest Energy Research program to measure photometrics of skylights so that we could actually calculate the spacing criterion of skylights.

Next slide, please. So what we did is we -- click about four times, please -- what we did was we measured the distribution of light intensity underneath skylights.

Next slide, please. And from the result of these tests we were able to generate photometric reports very much like that are done for electric light fixtures using the same kind of testing protocol and using the same calculation methods, we were able to develop spacing criterion for skylights.

Next slide, please. And so first off we looked at the spacing criterion of white skylights. It's a very common glazing material used in skylights for diffusing skylights. We took these photometric measurements for skylights under clear skies, and looked at them for each 10 degree of solar elevation that the actual distribution underneath the skylight changes, as the sun angle changes.

So we looked at the range of sun angles. We looked at very diffusing glazings, these white glazings, and we'll talk about haze in a little bit. But, make note that it had a haze value of 100 percent, which is a definition of its ability to diffuse the light.

And we looked at three skylights, a single glazed white skylight and also a double glazed clear over white, as well as a white skylight that was of a compound parabolic shape.

And all of these were over one foot light well, which is sort of the minimum light well height. And just for any of you who wonder what a compound parabolic skylight looks like, I've shown it here.

Next slide, please. So when we plotted

this spacing criterion, or the frequency of the spacing criterion for all these various tests, we had, you know, a series of tests for various sun angles for these skylight types.

When we plot the frequency of the spacing criterion what we find is that over 80 percent of the spacing criteria are 1.4 or less.

Next slide, please. We also looked at the spacing criterion in two directions; one which was sort of the north/south axis. And the other one is the east/west axis. Again, we find that, looking on the other axis, which is the east/west axis, again we find that in general right around 80 percent of the spacing criterion measured were under 1.4 or less.

Next slide, please. So the question arose whether or not skylights with diffusers might have a distribution that was markedly different. And that we might, by having a different spacing criterion, we might be disadvantaging skylights with diffusers.

And so we also took measurements of skylights with flat prismatic diffusers on the bottom of the light well. And we looked at two different types of skylights, a flat glass or clear skylight with a six-foot deep white diffusing light well. And a medium light skylights that had either a six-foot or a three-foot specular. Specular means like a foil, a mirror-like surface light well.

Again, all of these with a prismatic acrylic diffuser on the bottom of the light well.

Next slide, please. And again what we found was that the spacing criterion for all of these tests on 80 percent of the time the spacing criterions were 1.4 or less.

Next slide, please. Similar kind of information when we looked at a different axis of measurement, when we looked on the east/west axis versus the north/south.

Next slide. So, as a result we said 80 percent of our results have spacing criterions that are less than or equal to 1.4. And so we would recommend that we revise the daylit zone definition so that instead of expanding the footprint of the skylight, for the definition of the daylit zone, we expand that footprint by 70 percent of the ceiling height, which gives us an effective spacing criterion of 1.4.

Next click, please. Which gives us --

before we had sort of the splay angle of 45 degrees as it was drawn in the nonresidential manual. And so we recommend that that splay angle be changed to 35 degrees.

Next slide, please. The next issue was - this is really sort of a cleanup measure. Some of the definitions in the existing standard have exchanged the concept of effective aperture for well index -- I'm sorry, well efficiency for well index.

And so this definition looked at, or we've revised the definitions for effective aperture to be clear that indeed the effective aperture is the skylight area times the transmittance of the glazing in the skylight, times the well efficiency, divided by the daylit area.

And before it was not clear what the area was intended. And so we intend that this effective aperture is over the daylit area. And I kind of jumped out of order.

We also suggested that there be some corrections to some of the definitions in the standard, and that well efficiency, even though it doesn't change the actual calculation of well efficiency, but that it be brought in concordance with the calculation methods used by the Illuminating Engineering Society of North America that they've been using since 1992. So just bringing the standards into concordance with the lighting design community.

Also, previously the skylight area was defined as the surface area of the skylight. And if you use the surface area of the skylight it would not provide the correct estimate of illumination inside the space.

In addition, the definitions of U factors in the standards are based on the ASHRAE method, which looks at the heat transfer per rough opening of the skylight. So this would bring the values that are used in the U factor calculation, or the U factor calculations in the standard, bring that also into concordance with the lighting definitions, as well.

So, these are just cleanup measures in terms of making everything internally consistent.

Next slide, please. The next recommendation was around automatic daylighting controls. From doing some analysis of a variety of different controls, which are detailed in the full proposal, we found that multilevel control provided substantially more savings than a single level control. It had the additional benefit that multilevel control is less distracting, and that if you just have lights turning on and off with not any intermediary steps, it's a greater change in illuminance.

Then we also provided a definition of multilevel, which is that we have at least one control step that is between 50 percent and 70 percent of the design illuminance. And that that multilevel control shall control the electric lighting so that it consumes less than 35 percent of its rated power when it controls that minimum light output.

Next slide, please. This is an example of a two-level soft control where at first we're turning, we've got all the lights on, there's sufficient daylight. We turn off half of the lights. And then as we exceed our design illuminance we turn all the lights off. And that line there is both the fraction of illuminance from our electric lighting system; it's also our fraction of rate of power for that system.

Because when we turn half the lights off we get half the light output; we also have half of the energy input.

Click once, please. And this two-level plus off control would qualify as a multilevel control because it has a control stage that is between 50 percent and 70 percent of illuminance. And at its minimum light output consumes less than 35 percent of full power.

Next slide, please. Metal halide dimming. I have to use two lines here because the light output and power consumption are different at -- they don't follow each other.

And what we see here is that we have the lighting control, in terms of its light output, can reduce itself down to 30 percent of light output when there's available daylight. However, the power consumption, that's the red line, even at minimum light output, is consuming about 56 percent of its full rated power.

Click once, please. So, this particular control, it would comply with the issue of its ability to adjust its design illuminance between 50 and 70 percent; however, since it consumes greater than 35 percent of full power, metal halide dimming would not qualify as an appropriate multilevel control.

Next slide, please. One of the issues associated with having skylights in a building is that there's been some question about whether or not the controls are reliable. And a lot of times the discussions that we've had from our extensive research on controls has been that commissioning is one of the stumbling blocks.

And from these interviews several different issues have been brought up. And so first off, these control are not necessarily in the same room as the electric lights. And so having an indicator light telling you that you've actually changed a control state from the lights being on to those being off, is important.

The second issue of the time delay being able to be overridden, or being set to less than five seconds is important. Because if you have to wait five minutes to find out that you're at or above the control stage, that makes it time consuming to calibrate.

The light sensor, having a linear response, is important so that when you've calibrated that light sensor for a given condition, which may not be the design illuminance you're shooting for, that you can have relative confidence that when you adjust back that control that you're actually at the point that you want to be at.

And also one thing that has been commonly discussed is that when someone's trying to calibrate the light sensor, they're actually having to make adjustments to that light sensor, itself. That commissioning agent is self shading, or is shading the light sensor, so you have the whole problem of the person making the adjustment is impacting what you're trying to measure.

So, you know, all these things are based on that.

Next slide, please. And the question has come up, what does a linear response, and I'm showing here the photosensor sensitivity of two different types of light sensors. One is a photodiode cell that basically gives a linear response, that's the green line. Versus a photoconductive type sensor that has a very non linear response with light output.

Next slide, please. The other issue is that if I have to get up on a forklift or climb a ladder to adjust these controls, going to have a problem keeping them in adjustment. So this is bringing those controls down to the ground.

And that the controls have some kind of indicator, so the setting can be distinguished easily. So you just don't have two points that says high and low, but something that actually has some gradations in there so people have a reasonable understanding of where they're at.

Next slide, please. Also, with the Public Interest Energy Research program we tested glazing properties of various skylights, looking at both transmittance and diffusion in terms of haze. The haze measurement is a very inexpensive test. Costs less than $10 a sample, so it's not creating an undue burden on the manufacturers.

Next slide, please. And the haze measurement essentially uses an integrating sphere. At first the light is reflected through integrating sphere and we get total transmittance.

Next slide, please. Then a light trap in the back captures the direct transmittance, so we have, as a result of detectors measuring diffuse transmittance, so we end up taking the ratio of diffuse transmittance to total transmittance, and we have a reasonable single value for haze so we can understand how diffusing that glazing is.

Next slide, please. And from our test results we found that when we looked at different glazing materials, materials that were either clear or had other characteristics that would indicate that they would be glary, such as twin-wall polycarbonate or single sheet of fiberglass, that those were below 90 percent. And so a reasonable definition of a diffusing material is something that had a diffusion value of greater than 90 percent, including a prismatic diffuser.

Next slide. So our conclusions are, as I mentioned, that good diffusing materials so that we're spreading the light, not creating a glare issue with skylights. That those need to have glazing, glazing with haze values greater than 90 percent.

We also would allow that the manufacturers could use a diffuser. And so there's readily available diffuser materials that have haze values greater than 90 percent. So, we're not eliminating any particular skylight product from the market, as long as they provide additional diffusion.

Next slide, please. The next issue is that unless we turn the lights off in the space, adding skylights actually increase the energy consumption of the building. And so if we're going to have skylights in our space of any magnitude or any, you know, area over a certain amount of area, we certainly want to have controls turning off the electric lighting system.

And we talked to several controls manufacturers and found that it's quite easy to get a multilevel automatic daylighting control that costs less than $2000.

So, given that then we looked at what is the life cycle cost savings. And actually these were TDV, time dependent valuation savings that were between $1.50 per square foot and $4 per square foot, depending on how much lighting you're controlling, and the amount of skylights you have in your area, or in the space.

And given that, photocontrols are clearly cost effectiveness in enclosed spaces greater than 25,000 square feet.

Next slide, please.

MR. ELEY: 2500.

MR. McHUGH: I'm sorry, 2500. One of

the drawbacks, though, is that in our conversations with electrical engineers and lighting designers is that most of these folks do not have that much experience with photocontrol systems. And so we thought that what we would propose is that you could either use a photocontrol system or you could use an astronomical time clock to provide the control. Time clocks are more readily available. People have lots of experience with using those.

But at the same time we really want to move the market into using photocontrols because there's additional savings for photocontrols, and over the long term will be more reliable once people understand how to design with photocontrol systems.

Okay, the question was asked, what is an astronomical time clock. An astronomical time clock has a logic circuit in there that calculates the sunrise and sunset times based on the longitude and your time zone. And therefore you can set your lights to come on and turn off based on how close you are to sunrise and sunset, how many minutes or hours you are from sunrise or sunset.

MR. HOROWITZ: Quick clarifying question?

MR. McHUGH: Certainly.

MR. HOROWITZ: On a cloudy day does this astronomical time clock work if it's raining or it's dark outside during when you think it's daylight?

MR. McHUGH: That's a very good question, and part of the requirement if you use an astronomical time clock would be that you'd have to have the same override controls that are required for night controls, which is an override switch with a maximum of a two-hour override.

So, that's a good question.

MR. ELEY: The answer's no, though, right?

MR. McHUGH: The answer is no, that's correct. But there's a way of dealing with it.

Okay, then the other aspect is that we propose that a power adjustment factor incentive be allowed for the use of photocontrols. And that we would use half of the calculated savings of the photocontrols compared to no controls with the idea that the time clock is providing about half of the savings. And that you're getting credit for that increment above having a time clock by having photocontrols.

And that this power adjustment factor would be available only for systems that are under diffusing skylights. Again, the haze being greater than 90 percent.

Next slide, please. So, we calculated the power adjustment factors for buildings with lighting power density of .7 watts per square foot, or storage areas. And also high levels of lighting power density, 1.6 watts per square foot, more typical of retail.

And from that we calculated an equation that would match -- can you click twice now -- and so we came up with an equation -- could you click one more time -- that would match these and basically fill in the area between those curves based on the lighting power densities. And so we came up with this equation that defines the lighting power -- or the power adjustment factor based on the effective aperture of the skylighting system and the lighting power density of the light that's being controlled.

Next slide, please. So, finally, the last proposal as part of this package of measures is to prescriptively require skylights for some occupancies. And the proposal is that, you know, skylights have been found to be a very cost effective method of saving energy. In the report it's documented in the benefit/cost tables that look at the cost of skylights and controls as compared to the cost of installing those -- or as compared to the energy cost savings from installing those things.

Across the state right now the investor-owned utility, nonresidential new construction programs, 22 percent of the total savings from those programs come from daylighting controls. Those are primarily under skylights.

And as a result, you know, this well proven technology should be a requirement, part of title 24, as a method of reducing energy consumption in the appropriate buildings.

Next slide, please. So, first off we want the space to be directly under a roof. We want them to be low rise, we're not looking for skyscrapers. We want these spaces to be greater than 25,000 square feet. And we're not looking at a mall with a bunch of small spaces in it, but a large spaces greater than 25,000 square feet. And that these spaces have ceiling heights greater than 15 feet, and general lighting over half a watt per square foot.

For those spaces that meet those sort of list of requirements that half of that floor area of that enclosed space needs to be in the daylit zone, prescriptively would need to be in the daylit zone. And would be required to have skylights with haze values greater than 90 percent. And that the skylight area be the lesser of a skylight-to-floor ratio, or an effective aperture for those spaces.

And those minimum values would be that you'd have 3 percent skylights; 3 percent of the floor area, you'd have skylight area that's 3 percent of the floor area when the lighting power density is either between half a watt and one watt per square foot. And when we get to building types that have higher lighting power densities greater than one watt per square foot, that the skylight-to-floor ratio would be 4 percent or greater.

And that this would also -- based on the preexisting tables, the preexisting envelope tables that all these spaces would require double glazed skylights except for unconditioned spaces.

And part of this proposal is that we're suggesting that skylights also be required in unconditioned spaces. And that the Commission has the authority to do this through SB-5X. So, that skylights can be required as part of the lighting efficiency measures in the efficiency standards.

But the double glazed aspect is an envelope requirement, and therefore for unconditioned warehouses single glazed skylights would be acceptable.

I think that's it, is that right? Is that my last slide? So, ready for questions.

MR. ALCORN: Gregg Ander.

MR. ANDER: Jon, on the last slide that you had did you do any parametrics to test for 3 percent versus 4 percent by climate? For example, I'm surprised if you had LPDs of, you know, 1 to 1.5 in say Santa Monica or coastal areas that you would probably optimize somewhere higher than 3 or 4 percent.

MR. McHUGH: These are minimum values. And so I tried to be conservative with the areas. As it turns out, you know, the optimums or minimums that you might use in the desert might be slightly lower and places on the coast would be higher. So I tried to pick a medium value, but it's still on the conservative side, so that we're not --

MR. ANDER: And this would be a prescriptive package, right?

MR. McHUGH: Prescriptive minimum package, that's right.

MR. ANDER: Couldn't you set it up by climate zone, though?

MR. McHUGH: You could, and that's actually one of the comments I was looking for today, probably unless there's any particular objection, I think it does make sense to make those numbers change by climate zone.

But they really don't change that much, but they do change somewhat. So what happens is 14 and 15, climate zones 14 and 15 tend to use lesser amounts. Climate zones 10 through 13 sort of have this intermediate amounts. And then 2 through 9 need the largest amounts.

And then 1 and 16, we've suggest that 1 and 16 not be considered.

MR. ANDER: We've done a lot of parametrics, and depending on climate the optimization would come out between 3 and 7 percent. So, which we could share with you.

The other thing, did you look pretty close at different U values? Again, in mild climates I'm surprised that a double glazed unit would be cost effective.

MR. McHUGH: Yeah, that's interesting. And it actually is in this document. Just while we're discussing it, there's a series of parametrics that are -- oh, yeah, okay.

If you look on page 33 of the document that you may have picked up at the front desk, we look at the benefit/cost ratios of single glazed acrylic skylights versus double glazed. And then there's this third column that's set off, which is the benefit/cost ratio of moving from single to double glazing.

And what you find is that it's cost effective in most situations to move to double glazing as long as you're not in climate zone 7. And you can see that because the numbers that are less than benefit/cost ratio of 1 are white, and then they start getting shaded darker and darker as the benefit/cost ratio increases.

Now, remember this one was for retail.

And so this is assuming that the building is both heated and cooled.

If you actually look on page 35, which is your unconditioned warehouse, not surprisingly, of course, going from single to double makes absolutely no sense, because you're not paying for heating and cooling, and going from single to double actually reduces the transmittance of the skylight.

So, --

MR. ANDER: Yeah, what we've found is -- we can talk about this offline -- is that in some of the more mild climates like 6 and maybe even 8, that double glazing in buildings with significant internal loads, like retail, actually traps more heat into it and increases cooling loads or tonnage because of that.

But now there's a --

MR. McHUGH: Well, yeah, and that would be reasonable given what we found for climate zone 7. Now we didn't look at climate zone 6, but you'd expect that 6 would be very similar to 7. And, you know, 8 would tend to be similar, too.

MR. ANDER: Now there may be a comfort issue there in terms of mean rating exchange, but

again, in a retail setting it's probably less
critical because people are probably moving.
MR. McHUGH: Right.
MR. ANDER: As opposed to a school or an
office or something --
MR. ALCORN: We have a related comment,
I think, here.
MS. BOYDSTON: I have a related comment.
Rachel Boitson from the DayLite Company. Wouldn't
all of this be eliminated by standardizing
photometric testing for all skylights?
MR. McHUGH: What would be eliminated?
MS. BOYDSTON: All of these questions.
Why mandate a skylight to floor ratio if you have
a photometric on your skylight and can lay it out
just like an artificial light?
MR. McHUGH: The reason for that is that
just having the photometrics for a skylight does
not give you the correct indication of the
appropriate sizing of your skylighting system.
When you look at the overall energy
efficiency from a skylighting design you're
looking at the tradeoffs between the electric
lighting turned off versus the amount of heating
and cooling loads that are affected by the change

in the solar transmittance of the envelope, as well as the thermal transmittance of the envelope.

So, if you have photometrics that wouldn't really change the issue in terms of, you know, how many skylights you would need to save energy. It would just tell you what is the amount of light available at a given time of the year.

MS. BOYDSTON: Right. And then the CEC could mandate a certain number of hours per day to be shut off by a skylighting system, correct?

MR. McHUGH: Well, again, the number of hours a day, it's a tradeoff between what are the energy losses through the skylight relative to the lighting savings.

MS. BOYDSTON: So we would need to add in the U factor.

MR. McHUGH: Right. And these calculations have looked at that, the transmittance versus the U factor. And given the responses from your company we also, you know, have suggested that we also look at an effective aperture, which looks at the light transmittance of the skylights.

MS. BOYDSTON: We're very supportive and very excited about the CEC's research, and the HMG group's research. It's extensive and we're very excited about it.

However, I believe it could all be simplified by requiring skylight manufacturers to test their own products, as opposed to asking other independent research organizations to do that for them.

It doesn't encourage technology advancement by placing a minimum. What it does is allow all manufacturers to meet the minimum, and it doesn't encourage them to design systems that exceed that minimum.

MR. McHUGH: Well, yeah, this is one of the challenges of energy standards. In general, energy standards remove the lowest performing buildings from the building stock. It does not -- energy standards does not dictate what happens when people want to exceed the standards. And in fact, that's more appropriately the role of the utilities when they are encouraging emerging technologies, as well as the companies, themselves, that they have something that they feel is -- or that they can actually show is more beneficial to the customer than a competing product.

So, it has to do with what is the role of energy regulation versus market transformation.

MS. BOYDSTON: So, okay, I might be misunderstanding, and I'm new in this whole industry, so forgive my ignorance. But it's my understanding that the purpose of title 24 is to promote energy efficient buildings, right? While decreasing the consumption of energy in these buildings, correct?

MR. McHUGH: That's correct.

MS. BOYDSTON: Okay, so then we're mandating a skylight-to-floor ratio based on those types of assumptions, correct?

MR. McHUGH: The skylight-to-floor ratio is based on the calculations that a certain skylight area will provide savings over having no skylights at all.

And because of the time limitation I didn't go into the detail of the effective aperture, but given the response of your company to just having a straight skylight-to-floor ratio, recognizing that potentially that there might be some companies that develop highly transmitting skylights more than the medium white skylight that we used for analysis, we also placed into this, as the slide said, that we would also have a limitation based on effective aperture so that if you wanted to use less skylight area and you had a very transmitting skylight, that that would be acceptable.

MS. BOYDSTON: And we definitely concur with the effective aperture. The only issue we had with it was that the well cavity ratio characterizes the geometry of the skylight well, and it is used for calculating those skylight well efficiencies.

However, the well efficiency is calculated by the reflectance of the well, or the reflectance of the walls of the well. And on this calculation, as far as the well efficiency is concerned, we only have reflectance of 40 percent, 60 percent and 80 percent.

Wood is absorbing, it doesn't reflect. And for the most part, a skylight has a one-foot well, and it's not reflective at all, it's absorbing.

MR. McHUGH: Well, even an absorbing material it's reflecting, so, you know, 40 percent reflecting well is actually quite a dark well. If what you're interested in is more -- we can develop more lines on that graph if you feel that there might be darker skylight wells.

Or we could actually set a minimum reflectance if, you know, 40 percent as a minimum reflectance, which is not much of a requirement.

MS. BOYDSTON: We'll support whatever kind of specifications would encourage daylighting as a minimum, definitely.

But I think that the onus should be on the manufacturer to have their product tested so that it's readily available for architects and designers, as well as building owners, to mandate what they want as far as lighting fixtures in their buildings.

MR. McHUGH: I guess one of the issues that would come up is that currently there is only one lab in the entire United States, or as far as I know, the world, that has facilities currently set up to test the photometrics of skylights.

You know, over the long term that's perhaps a reasonable thing. This particular code proposal is not suggesting the photometrics be required as complying with the standards.

It's an admirable goal to have photometrics for all skylights --

MS. BOYDSTON: We would like it on the record to say that we support that.

MR. McHUGH: Okay, that'd be great.

MR. ALCORN: Thank you, Rachel. Bill Pennington wants to respond to Gregg Anders' question.

MR. PENNINGTON: Yeah, Gregg, perhaps to your surprise the AB-970 standards require, as a prescriptive requirement, skylights to be double glazed.

MR. ELEY: Or better.

MR. PENNINGTON: Yeah.

MR. ANDER: That is surprising.

MR. ELEY: Better in some climates.

MR. McHUGH: Yeah, that was actually one of the things I looked at and found that for plastic skylights that need to be double glazed in all climate zones.

MR. ALCORN: Okay, Tom Trimberger, you had a question or a comment?

MR. TRIMBERGER: Trying to understand a little bit of this. First of all, -- lost here -- on slide 20 you talked about control being readily accessible to authorized person. I don't know if that's in your language, readily accessible?

MR. McHUGH: Readily accessible is actually a definition that's currently in the standards, in the definition section. And I think it was there for shutoff controls was the original, where it was originally used.

MR. TRIMBERGER: In code language that usually means it's accessible without a tool or a ladder, and also it's not covered by a door.

If you have to open up the door of a control panel it's not readily accessible. That might --

MR. McHUGH: Okay.

MR. TRIMBERGER: -- be something we would look -- I don't know if that's what you intended. I just --

MR. McHUGH: Okay. I didn't intend that it not have a door on it, but I certainly --

MR. TRIMBERGER: I didn't --

MR. McHUGH: -- intended that it be on the floor and, you know, that you didn't have to climb up a ladder to get to it.

MR. TRIMBERGER: If we've got it covered with definitions, I know building code has a definition of it, in one sense.

Looking at the prescriptive requirements for skylights in large low rise, nonresidential buildings, looking on page 42. You go through what it is. And I'm just trying to get a grasp of what this is.

So you've got a large space, whether it's conditioned or not, you're going to want either 4 percent or 3 percent of the floor area in skylights?

MR. McHUGH: That's correct, yeah.

MR. TRIMBERGER: That's a mandatory requirement?

MR. McHUGH: Prescriptive requirement.

MR. TRIMBERGER: That's prescriptive, so if you do a performance approach you don't need to do that?

MR. McHUGH: Yeah, you went through the performance calculation.

MR. TRIMBERGER: Okay. What about, you know, often they'll build a large warehouse and not sure how it's going to be divided up into pieces. So, you know, if you build say a 50,000 square foot warehouse, speculative building --

MR. McHUGH: Yeah, the whole issue of the core and shell buildings is what you're getting at.

MR. TRIMBERGER: Yeah, and you know, if they divide it into two equal pieces, then the whole thing needs skylights. If they divide it into two unequal pieces, then one of them needs skylights. If it's divided into three pieces, none of them need skylights.

So how do I build the shell?

MR. MAHONE: Yeah, I think if they build it unsubdivided, then they put in skylights. The lighting system is often left for a tenant improvement later on. So how they set up the circuiting and the controls could be dealt with when they do the tenant improvement.

But the shell would go in with the skylights.

MR. TRIMBERGER: Or they can retrofit them later, however I, as the building official, want them to do it.

Is that the way I do that, or is there a rule?

MR. MAHONE: Well, I think the way this is written the interpretation would be unless you subdivided from the get-go, it's 25,000 square feet and put in the skylights.

MR. TRIMBERGER: Okay, then it's --

SPEAKER: Of course, if you don't know the lighting yet, it's going to be under --

MR. TRIMBERGER: It's a shell, auditorium, movie theater, museum and refrigerated warehouse then.

(Laughter.)

MR. TRIMBERGER: I'm just saying this is the way the game is played by people who know how to play the game.

That's just an issue. I don't know if we have an answer to that, or you know, maybe it is best left --

MR. McHUGH: I've thought about this issue and I haven't come up with a good answer to it yet, so -- we've been thinking about this and we've been trying to get some comment on just this very issue, how to deal with core and shell.

MS. BOYDSTON: We would support being seen as a lighting fixture.

MR. ALCORN: Okay, Mike Gabel, please, and then Noah.

MR. GABEL: Try to make this as brief as I can. Mike Gabel, CABEC.

On the same page 42 it says unconditioned areas having LPDs greater than .5

watts per square foot required to have skylights.

Well, it's kind of an oxymoron because you don't have unconditioned areas having prescriptive requirement, only conditioned spaces fall under title 24.

MR. ELEY: Forgot to change that.

MR. GABEL: Well, that's changing, but let's see, how are we going to model performance approach -- are we going to have --

MR. PENNINGTON: I guess this will turn out to be a --

MR. McHUGH: For the warehouses.

MR. GABEL: Unconditioned space is --

MR. McHUGH: You don't have anything to trade off.

MR. GABEL: That's what I'm saying, so it's not prescriptive, it's mandatory then. Okay, so you're going to have to change the column where that sits, if that's your intent.

Jon, just so I understand it, the adjustments, the LPD power adjustments from daylighting controls was an algorithm that you showed up there before?

MR. McHUGH: That's right.

MR. GABEL: Okay, so it's --

MR. McHUGH: It's just a curve fit.
MR. GABEL: It's a curve fit, okay.
MR. McHUGH: I mean the first curves are, of course, data that's modeled. And then this power adjustment factor is just a simple linear curve fit.
MR. GABEL: And that is based pretty much on first principles and hourly schedules and so forth --
MR. McHUGH: Exactly, yeah. 1991 schedule so that, you know, --
MR. GABEL: Okay. I think what I'd be interested in is, I'd approached PG&E very preliminary format, is discussing some changes to the nonres performance ACM rules where daylighting could be modeled actually in buildings. And there's some advantages to doing that.
I would foresee it more like a chiller where a chiller has a default curve, and daylighting would have a default modeling set of assumptions.
I just don't think we should be that simplistic in the performance approach. I mean I think it's great for prescriptive, I think, because you guys have done a good job. But I'm

interested in pursing whether we can add some new modeling capabilities for daylighting as part of -- which we've never had, by the way, explicitly, so --

MR. PENNINGTON: But that's been considered from time to time. But, you know, it could get into very complex situation and very difficult to enforce with all that, so that's --

MR. GABEL: Well, I guess my idea is like --

MR. PENNINGTON: -- been our decisions in the past.

MR. GABEL: Well, like chiller curves, you can use a default instead of assumptions which are conservative, and not give the store away. But, model more appropriately to the daylight zone that you have in the DOE2 model then in a more sort of prescriptive approach.

I think with TDVs you're going to get a lot more credit for daylighting control in general, because the weight of source energy in the peak hours is going to be greater than it has been under the current standards.

MR. McHUGH: I should mention that the PAFs that are calculated here have TDV incorporated into them. So, I did it on an hourly basis and multiplied it by the TDVs, so that --

MR. GABEL: Yeah, I'm just suggesting it would be good to explore. I don't think it would take that much to explore in a preliminary fashion whether this is do-able in a short timeframe without a lot of investment time and energy to create that.

MR. MAHONE: Yeah, I agree in principle. The modeling of daylighting under DOE2 for a simple skylighting system like we're doing here could be very simple. I mean, it could be kind of hardwired into the ACM so that it's a pretty straightforward model.

I think what's frustrated us in the past is trying to think about modeling daylighting including all the kinds of daylighting conditions like monumental skylights and side lighting, and for those it does get very complicated. I agree completely with Bill's comment.

But for the kind of general illumination through skylighting that's envisioned in this proposal, the modeling is very simple. And DOE2 is very well set up to do it. You could adjust the ACM so that it would be simple to implement.

MR. GABEL: I'm also thinking about sidelighting and simple perimeter zones, you know, things where you have fairly simple geometries and fairly simple sets of assumptions which will still give you much better, more accurate data generally than, you know, a preordained value which is building specific.

So, anyway, I'd like to pursue that.

MR. PENNINGTON: The decision in the notice of maximum scope was that we would look at compliance options after the standards were adopted. And, so I would have a little bit of openness to doing it at that point.

We also decided we were not going to address side lighting in this round of standards. So, I'm not really open to that.

MR. GABEL: Not beyond what's in the current standard, is what you're saying?

MR. PENNINGTON: Right.

MR. GABEL: Yeah.

MR. ALCORN: Because we're under a pretty significant time constraint here, and we're over on this topic, I'm going to take about another two or three minutes on this, and I want to hear from Noah, Tom Trimberger and Mazi

Shirakh.

MR. HOROWITZ: We're very supportive of the inclusion of daylighting and we're glad to see it's handled on a prescriptive format.

As one who can't program his own VCR, controls can be frustrating to some people, and as a result they're either dissatisfied or they find a way to override the system.

So I think part of the way to overcome that is to have a lot of training in the time before people become more comfortable. So I'm hopeful the utilities and other funders good at spending other people's money have been accused, let's make sure in 2003 and 2004 we continue to have the training so we have a smooth transition here.

MR. McHUGH: I'd like to mention that we're involved with Southern California Edison. We're about to initiate some studies on characterizing the controls in existing buildings, where they're working, where they're not.

And the idea is that the end result is to have some design guidelines for the design practitioners and for the controls companies.

MR. HOROWITZ: That's great, and then to

actually get it into people's hands.

That's all, thanks. Good luck.

MR. PENNINGTON: One or two more comments here. Who else had a comment, quickly?

MR. ALCORN: Go ahead, Tom.

MR. TRIMBERGER: Just real quick. The idea of the shell building. Kind of by definition has a lighting power density less than a half watt per square foot, so I think that would kind of be exempt until it got lighting in it, then you would know whether it needed the 3 percent or 4 percent. So that might be one way to address that.

And then you said side lighting, daylighting is not required -- not changed. But the multilevel controls would still apply to daylit areas from sidelighting, is that correct?

MR. McHUGH: This proposal was written specifically for skylights. We had left it open for the Energy Commission team to consider that, but that was outside of our scope. We were looking at just skylighting.

And part of the reason for that is that the controls needed to control electric lighting under skylights are a lot more -- is actually a simpler problem than the issues associated with controlling side lighting.

And so we thought that as a first go-around, that it made sense to focus on the easier problem than actually the harder control problem.

MR. TRIMBERGER: Thanks, Jon.

MR. SHIRAKH: Mazi Shirakh, CEC Staff. Jon, you were talking about multilevel controls and you came up with a definition. And then you showed that metal halides actually don't meet that requirement.

MR. McHUGH: Well, dimming metal halides don't meet that. So, for instance, if you used a switching control with metal halides, those would meet the requirements, you know, if you did a two-level plus off.

But if you tried to use the existing technology, or, you know, these curves are actually a couple years old, you know, these are maybe three years old, these curves. And the savings are quite, you know, dim your lights down to 30 percent and you're still consuming over half of the power. That these wouldn't comply.

And so it implies two things. One is that dimming controls for metal halide are not a particularly great method. And so you might consider using actually more efficient sources like fluorescents. We're seeing, you know, lots of T5 high output lights being used.

May also create some impetus for the metal halide industry to work on fine tuning their product. So I don't see that it's particularly a problem outside of it's going to make people rethink how they design lighting systems in these large enclosed areas.

MR. SHIRAKH: So, you know, I guess the reason i'm asking this question, this is very popular in like Costcos and Home Depots, and they use metal halide. So then the solution for them would be to either go to a different technology or just switch them on and off basically?

MR. McHUGH: Right.

MR. ALCORN: Thank you, Mazi. And, thank you, Jon.

MR. McHUGH: Thank you.

MR. ALCORN: Good presentation. Okay, we'll move to the next topic now, which is cool roofs prescriptive requirement. That will be presented by Hashem Akbari. Hashem.

DR. AKBARI: I've been asked to try to accelerate the presentation of the materials, and

I think that we are talking about basically a topic there is a general consensus and agreement by the program that the Commission have already sponsor to install a lot of cool roofs in California. So, we are trying to take advantage of that move.

I would like to say that we already -- I am having -- I'm here as an LBL representative, at the same time this study is being shared and sponsored by Pacific Gas and Electric. Many people at PG&E, at the Commission, at CRRC have helped us to come to where we are.

And the numbers that we would be using in these studies are all going to be based on what CRRC will be providing.

So let us move to the next slide. This is a very important one. I would like to say what is the current scope. The current scope is that we already have in the previous version of the code modification, AB-970, some proposed modification for to give credit to cool roofs.

Now, this is the first attempt that we are trying to go only for nonresidential lowest slope roofs and perform a detail on all to suggest that to be used as a prescriptive case.

The current standard, the way it exists, applies to the other building types that are listed, such as nonresidential building with high slope roofs, high rise residential buildings, low rise residential building, guest room hotels and motels building.

My hope is that as we go forward we will do more analysis and we would put one of these things in the top, or all of them in the top eventually.

Next, please. The other thing that we have done before previously the way that the modeling had been done, at least in the overall envelope approach, was only good for the non metallic surfaces. This time the prescriptive approach allows for non metallic surfaces to be considered as part of the prescription.

In addition, for the metallic surfaces, the surfaces that have very low emissivity, if they are exceptionally reflective they also will be considered as cool roof. So they're also included in that.

The benefits that the cool roof has we all know about in terms of the electricity saving, peak demand saving and also lowering the ambient temperature which does have its own positive consequences.

Next, please. The environmental benefit that we get from the cool roofs are for buildings that condition or partly conditioned, or not conditioned, we are getting some increasing comfort. Lower surface temperatures in the areas that are plagued with smog would have better chance of improving their smog condition because of the lower temperature.

It definitely reduces the impact of the urban heat island in the summer, and also there are indications that cool roofs may last longer as a result of that it would require less waste disposal.

Like any other material, there is not only one side to it, there are other sides. The cool roofs in some area potentially add to, a little bit to heating penalties or add to heating energy use during the winter.

Depending on what type of generation facilities are available, it also may negatively impact the ambient air quality during the winter. Also for some of these roofs that may be washed by detergents in order to maintain its reflectivity, that may increase a little bit of water usage or detergent use.

Next, please. So, this is the current picture of title 24 after the AB-97. There is no prescriptive requirement; there is chances to get credit for the overall envelope approach. There is also chances to get credit for performance based approach.

The cool roofing products are already being defined for clay and concrete, as those have unusual reflectivity of 40 percent and emissivity of 75 percent. And for all the others with an -- reflectivity of 70 percent.

Next, please. What we are going to do is just to change the prescriptive, the standards so that it would include the reflectivity as the prescriptive requirement for the nonresidential building with low slope roofs.

Again, I have to emphasize that the reason that the scope is limited is that we have done only limited analysis for that section. And that doesn't mean it doesn't apply to the other areas.

The overall envelope and performance approach is slightly modified to offer credit or penalties if based on the prescriptive requirement. And also the changes in the requirement for cool roofing products have been made that the qualified low emittant products of metallic roofs would also be included. And also restricts the moderate reflectance clay and concrete tiles to low rise residential buildings.

Next, please. So the way that we did this analysis is to go through a thorough review of proposing by reviewing at what is the current technologies used in the market; what are the market shares. And what is the process of manufacture and distribution. What are the availability of different products. What are the potential incremental costs, if any. And what are the useful life, and what are the chances of the useful life because of the reflectivity.

Then we perform a building energy simulation and cost performance analysis while looking at three layers. Number one, looking at some measured data. And then doing a lot of DOE2 simulations. The DOE2 simulations were done based on the age reflectivity of the materials, rather than reflectivity of the fresh material.

And then we calculated net savings which is cooling energy savings minus the potential heating energy penalty. So it is all the numbers that are going to be presented are in terms of the net.

And after that we did project the statewide energy impact of these changes in the prescriptive requirement.

Next, please. We can basically skip this slide, but basically this slide is supposed to show that there are cool options for various low slope roofing materials. And as an example, if you would like to have a black roofing material, you have the option of having it white. And so if you want to have a single ply membrane, you have the option of having it both dark and white.

So, once you go through the analysis it come up to net energy savings, or dollar savings for all the 16 California climate region. Thank you, Charles, for moving away.

I would like to mention here that in all of these things, except this little area, we do have savings in excess of $200 to $300 over the lifetime of the material.

This climate zone one which is a very

small region up in the northern coastal region, it doesn't have much of a weight on the number of building in terms of the number of buildings. And after all, still, even in that area there is a potential savings of about $100 over the lifetime, per thousand square foot, over the lifetime of the material.

So, if we go with the incentive that California is providing, CEC is providing at the rate of 15 cents or 20 cents, you would find out that in all of these climate regions this prescriptive measure would make sense, and it saves energy and dollars.

Next, please. So, this is an estimate of projected savings. I would like to look at the last two lines. If you do TDV, time dependent valuation of the net savings, it is something in the order of 25 million; and if you do standard saving, it's something in the order of 20 million. And we are also estimating that conservatively perhaps we are saving about 10 megawatt for this market segment per year over this region.

So, in a way, in a process of ten years that would be about 100 megawatt. So this is per year data.

Next, please. So, this is my last slide. Basically saying that based on this -- analysis we have gone through the entire code section and modified different sections.

Some of those major modification includes section 101, definition and rules of the construction. Then section 118F, which the proposed language is also covered in this draft report.

And then the envelope component approach, both for the proposed and the standard that's being modified, the overall envelope approach is also being modified. The alternative to existing building that is alteration to existing building which is basically looking at how this measure applies to major modification to some of the existing building. That also being modified, so this standard, proposed standard is going to cover that.

And also for performance analysis the alternative calculation manual is being modified at the appropriate section to include reflectivity and emissivity.

One last point. Currently the proposal is based on the initial value of reflectivity that will be provided by the end of this year by Cool Roof Rating Council. And there is some correlation developed for the age value in terms of offering credits, but once the actual age value become available, we somehow foresee that we are going to modify that based on the --

That concludes my comments.

MR. ALCORN: Thank you, Hashem. We have a question from Bill Pennington.

MR. PENNINGTON: Chris, could you roll back to this slide right here?

I'm not sure you explained this quite -- I didn't understand it completely from what you said.

DR. AKBARI: Let me do it again.

MR. PENNINGTON: This represents, these bars represent the life cycle of the energy savings.

DR. AKBARI: Correct.

MR. PENNINGTON: So you need to compare to the cost to --

COMMISSIONER ROSENFELD: No, it says net, Bill.

MR. PENNINGTON: I don't think it's net.

DR. AKBARI: Let me explain it.

MR. PENNINGTON: Okay.

DR. AKBARI: This is the life cycle cost savings in terms of the energy dollar per thousand square foot. And it does the calculations in two way, using the time dependent valuation -- dependent, so this is the data.

And then there is a little bit of an -- up in here. This is showing the incremental cost of having cool roof. For most products the incremental cost is below 20 cents per square foot. For most products. For a lot of products the incremental cost is actually zero.

So if you assume that there is an incremental cost of maximum 20 cents per square foot, then you would find out that this particular measure is going to be cost effective because all the savings are more than 20 cents per square foot. Except in California region 1, which is effective if the incremental cost is 10 cents per square foot, or $100 per thousand square foot.

MR. PENNINGTON: Okay. And the other part about this is that this analysis was done assuming a 10 SEER air conditioner as the basecase, rather than where the new federal air conditioner standard will be?

DR. AKBARI: That is indeed correct.

MR. PENNINGTON: So if you're comparing to the federal standard that will go into effect in 2006, which will be either 12 or 13 SEER, then the life cycle cost benefits would go down by 20 percent essentially, something like that, on each of these bars?

DR. AKBARI: That is probably correct.

MR. PENNINGTON: Okay. So I guess there is a little bit of issue whether it makes sense to have this requirement in climate zone 1, and if you're comparing to a SEER 12 or 13, are there some other marginal climate zones?

And, you know, I don't think we have really reached a conclusion on this that's completely definitive.

DR. AKBARI: Can --

COMMISSIONER ROSENFELD: As I understand it, it's pretty clear. He has 16 bars there, doesn't he? So, climate zone one, you said it exactly correctly, Bill. But it sounds like everything else is okay.

MR. STONE: Not necessarily because this is just the energy, Art. He was saying that this doesn't count the -- this is not net of the incremental costs. In some cases --

COMMISSIONER ROSENFELD: But the net is never more than 20 cents a square foot.

MR. STONE: But if you reduce this by 20 percent, --

COMMISSIONER ROSENFELD: Okay.

MR. STONE: -- and then you take that net, that 20 cents a square foot, in the first three you're pretty darn close. First three after climate zone 1.

COMMISSIONER ROSENFELD: Hashem should correct me, but as I remember from reading his papers, the average increment is more like 10 cents a square foot. I mean there's a range from zero to 20, but it's seldom 20. Is that --

DR. AKBARI: Yeah, I agree with you. Let me also make this comment. If you look at these three climate zones, except climate zone 1, the savings are in the order of $300 to $340 per thousand square foot.

If you discount that even by 20 percent, that's a reduction of about $60. So $60 minus $300, that is $240. Still more than $200 incremental, maximum incremental cost. Still it's going to be -- but it's not going to be perhaps as lucrative.

However, I would like to make the following points. The cost of electricity is going to go up. And these costs, as Art mentioned, are really the higher level that we can think about. This is about the most pessimistic way to think about it.

Most materials you can have them at basically no incremental cost.

COMMISSIONER ROSENFELD: I have another question. While all this is up here, I have a deeper question which is this is per thousand square feet. Now it seems like there's another first cost issue, Hashem. You're going to downsize the air conditioner.

DR. AKBARI: It's not included in this.

COMMISSIONER ROSENFELD: But I mean I'd like to -- I think it's significant. You say a few watts per square foot?

DR. AKBARI: At least a quarter watt per square foot, correct.

COMMISSIONER ROSENFELD: Okay, so that means in 1000 square feet you're going to downsize the air conditioner by 250 watts, or a quarter of a kilowatt.

But that's several hundred dollars in
reduced first costs.
DR. AKBARI: We have quoted that in our
report, but in this cost/benefit analysis we have
not included that.
COMMISSIONER ROSENFELD: But then it's
okay if I sort of add -- this is really, I mean
that would bring everything down by 250 bucks or
something.
DR. AKBARI: Absolutely.
COMMISSIONER ROSENFELD: So, at least
you ought to put it in your -- caption.
DR. AKBARI: I think that you're
actually right. The best we can say that the cost
of the roofing would be paid by lower --
COMMISSIONER ROSENFELD: Yeah.
DR. AKBARI: So basically it costs you,
even the most expensive roof, at no incremental
costs.
COMMISSIONER ROSENFELD: I'm just --
DR. AKBARI: Thank you, Art.
COMMISSIONER ROSENFELD: -- to Nehemiah.
MR. ALCORN: Okay, Jon McHugh is next.
MR. McHUGH: Yes, you're proposing these
cool roofs for flat low rise roofs, but not for

flat high rise roofs. I'm assuming that the cost effectiveness is the same per square foot. Is there something about high rise roofs that -- why you've pulled it off the plate?

DR. AKBARI: Let me mention why high residential buildings are excluded. Low rise residential buildings are excluded. Guest room in hotels, motels are excluded. And nonresidential buildings with high slope roofs are excluded.

MR. McHUGH: Oh, it's a slope, not low rise versus high rise.

DR. AKBARI: Everything that is a slope, is flat is included.

MR. ALCORN: Misti has a related comment, I think, here.

MS. BRUCERI: I do. Jon, I can also answer that question. The high rise residential are excluded from this analysis because they do have different and actually more strict envelope requirements.

And so we have not done the cost effectiveness on those buildings at this time. We would like to try to do a little bit more analysis after the workshop and see if we can include them, also. But it's not all high rise buildings.

SPEAKER: There's also more sunbathing going on.

(Laughter.)

MS. BRUCERI: I do have one other related comment about the conservative nature of this graph. According to Hashem's other LBNL studies, these are simulated savings, and they tend to be much lower than the actual savings because of a deficiency in DOE2.1's ability to model the radiant heat transfer in an attic.

So, these are actually conservative, even more conservative than what Mr. Rosenfeld would suggest.

MR. ALCORN: Thank you, Misti. Art, did you have a related comment to this?

COMMISSIONER ROSENFELD: Yeah, I'm also puzzled. What's wrong with a simpler view? I'm sure there's something wrong, but if a roof is low sloped and can't be seen from the street, and there aren't architectural concerns, then regardless of whether it's residential or commercial, why not just require it?

DR. AKBARI: I guess that -- if you do the analysis most probably you are right. And the only reason that we suggest or limited ourself to only to this one, and not included the flat roof residential, is that they are having different, you know, we haven't done the cost/benefit analysis for that because they are having differing envelope requirement, number one.

They are also running on different schedules for air conditioning. And number three, their air conditioning systems are different on typical nonresidential buildings.

But once you do this analysis based on the measure data that we have, I'll have all the confidence that would also apply to that.

COMMISSIONER ROSENFELD: But that means you're putting it off five years.

DR. AKBARI: You may be right, Art. You know, the whole point here is just that somebody somehow has to do that analysis. And that is something that is required.

And if you are going to, you know, kind of decree it, based on what you have seen in here, you have all my blessing.

(Laughter.)

MR. ALCORN: Nehemiah.

MR. STONE: Two points. First on the one you were just talking about, Art. The residential already has a prescriptive requirement for radiant barriers, and it would be very simple to say cool roof can substitute --

COMMISSIONER ROSENFELD: Substitute.

MR. STONE: -- for that same thing.

MR. PENNINGTON: Well, that essentially is the case now.

COMMISSIONER ROSENFELD: Oh, good.

MR. STONE: So, it's pretty much covered that way.

The other question I had, you're talking about making a change, Hashem, that would make it so the clay tiles are restricted to just low rise residential. And I'm not clear why.

Because there's something beyond the reflectivity and the emissivity of clay tiles that makes them energy efficient, and part of that is the space between the tile and the roof deck, itself.

And so they actually do perform pretty darn well. And it seems to me that same benefit would apply to nonresidential roofs where they have that kind of clay tile.

Why would you say they can't apply to nonresidential?

DR. AKBARI: I think that is mostly for practical application. I haven't seen any low slope nonresidential buildings with clay tile.

MR. STONE: I'd be happy to take you down to --

MR. PENNINGTON: I think he's talking about high slope --

MR. STONE: -- Norcor in Corona and show you some, because there's --

MR. PENNINGTON: Well, --

MR. STONE: -- MCA is doing it.

DR. AKBARI: Low slope?

MR. STONE: Yeah. MCA is doing it down there.

MR. PENNINGTON: Well, I thought your comment was related to high sloped nonresidential.

MR. STONE: No, it's just --

MR. PENNINGTON: Well, let's say it is. Let's perceive your comment for high slope --

MR. STONE: I'm sorry, --

MR. PENNINGTON: -- nonresidential.

MR. PENNINGTON: -- that's what I meant. Did I say --

COMMISSIONER ROSENFELD: That's what you meant?

MR. PENNINGTON: Okay, I thought that's what you meant.

MR. STONE: Excuse me. I meant high slope, I'm sorry. Of course you wouldn't put clay tile on low slope, sorry. I meant high slope. But they are doing it in --

DR. AKBARI: It is just again the whole point is we haven't done the analysis. This is only focusing on low slope. That's the part that we have done analysis, and at this time we are ready to put in our necks on the line to support and defend our analysis.

Where all the other parts, I'm not at all against it, it's just a question that once the analysis is done, then we would try to include it.

MR. PENNINGTON: Hashem, the current provisions cover a credit for tile in all these applications.

DR. AKBARI: Absolutely.

MR. PENNINGTON: So, with this analysis, it's only analyzing the nonres low slope. It seems reasonable to leave the rest with the provisions that they currently have.

DR. AKBARI: That's exactly what we have done. That's exactly what we are proposing.

MR. PENNINGTON: So then I think Nehemiah's comment would be satisfied.

DR. AKBARI: Absolutely. That's, you know, basically we are not touching that part. Only we are saying that for low slope.

MR. STONE: Okay, you got a slide that's wrong, then. Because one slide you did say that currently high slope, clay tiles are approved with the certain emittance and reflectivity. And you're saying you're going to change it so that they're not acceptable for anything other than low rise residential.

DR. AKBARI: Let me look into that.

COMMISSIONER ROSENFELD: Which number, Nehemiah?

MR. STONE: I don't have a copy of the slides. It's on page 3, it's about number 6.

DR. AKBARI: About slide number 6, so change the requirement for cool roof, okay. Say qualifies low emittant product with very high reflectance; restricts moderate reflectance clay and concrete tiles to low rise residential buildings.

MR. STONE: The very bottom bullet there, Hashem.

DR. AKBARI: So, you would like to have this in both low rise and high rise?

MR. STONE: It already is. And as this slide reads, --

DR. AKBARI: Okay, okay. You're right.

MR. STONE: -- you'd be eliminating it for --

DR. AKBARI: No problem.

MR. PENNINGTON: And high sloped roofs for nonresidential buildings.

MR. STONE: Right.

MR. PENNINGTON: High sloped for nonres high rise and low rise.

DR. AKBARI: Correct, no problem.

MR. ALCORN: Okay, Noah, you had a comment?

MR. HOROWITZ: Noah Horowitz wearing two hats. The first hat being with NRDC. This will be my subjective comment. And then I'll put on another hat being the Board Chair of the Cool Roof Rating Council, CRRC.

NRDC is very supportive of adding the prescriptive requirement here. And I think the cost/benefit discussion that you had with Art, we'd encourage you to rerun it with the SEER 12 and SEER 13, as well; as we have to imagine that we're going to be successful there.

And include the cost savings of the downsized equipment in there, and the incremental cost of the cool roof. Between all of that you'll probably have as compelling or more compelling results.

So, hopefully that's not too much work.

Shifting to the Cool Roof Rating Council side, brief commercial. CRRC's been around for about three years.

MR. PENNINGTON: Let me ask you a question, Noah. I want to know if you're advocating -- how much more money you're advocating to be spent on analysis here.

You're also looking for analysis to be done for low sloped high rise residential roofs, is that correct?

MR. HOROWITZ: No.

MR. PENNINGTON: You're not. You're not interested in that?

MR. HOROWITZ: It would be nice, but that's not what I was asking for.

MR. PENNINGTON: Okay.

MR. HOROWITZ: I'm saying just the

picture he had there to bring it more up to date with the points Art had raised.

COMMISSIONER ROSENFELD: Well, a parentheses. Maybe we can save some money here. The new air conditioner, the SEER 12, the federal air conditioner, isn't it pretty close to just 20 percent better than the old one?

I mean maybe we could just scale the picture and not have to work all that.

MR. HOROWITZ: As simplistic as appropriate, I'm not suggesting we need to do complicated --

COMMISSIONER ROSENFELD: But it needs another look at it.

MR. HOROWITZ: Yeah.

The Cool Roof Rating Council is roughly analogous to NFRC, which is for windows. And we've come up with a label that will contain, to start with, the initial performance so that its reflectivity and emissivity. And over time we hope to add the age performance data, as I think many people know, while a roof may perform very well initially relative to its reflectivity and emissivity, it's performance degrades over time due to dirt pick up, mold and so forth.

So we're going to have test forms set up where we're going to test data, so after three years we'll have data. So the earliest that would come into force is around late 2005, early 2006.

So, Hashem, if you want to just update the group again how you're going to handle the performance degradation? You'll be receiving the initial data.

DR. AKBARI: I mentioned that very quickly that all the analysis currently is being done assuming about the 20 percent reduction in reflectance. And doing the calculations on that base. And assuming that the emittance does not change when you are doing the performance analysis.

MR. HOROWITZ: So there'll be the default 20 percent once CRRC provides the age data, would that be used instead?

DR. AKBARI: That is correct.

MR. PENNINGTON: I don't think that's actually how the proposal is written. From my vantage point, I would feel better if we had a CRRC methodology in place, and knew when the certification was going to happen, and had that all in place before we put it into the standard.

So, from my vantage point it would be better to make that change in the 2008 code change instead of the 2005. Instead of just anticipating that this is all going to work out and all the issues related to it are going to get resolved.

I would rather not sort of have a hypothetical requirement in the standard if we can avoid it. We have one now, you know, and I'd rather not do that again, actually.

MR. HOROWITZ: So you'll have a default degradation in 2008 if everything's up and running then the actual data would be used, sounds like.

MR. PENNINGTON: Right.

MR. HOROWITZ: That sounds good.

DR. AKBARI: Thank you, Bill, on that comment, you know. I actually meant to say that one, but the intention has been that once we get the values we would modify the codes. And at this time, it's only building that 20 percent reduction.

MR. HOROWITZ: Okay. The last point is the Cool Roof Rating Council, as an organization, is meeting June 10th, and we're going to bring this proposal to them and bring back feedback to you.

There are also a couple of people who are members, been helping the CRRC. I don't know if you have anything else?

MR. PENNINGTON: Noah, could I make a couple of other comments. We would also like the CRRC to look closely at the requirements that there are for the operation of the CRRC that are in the administrative part one of the code. And if there's any need to fine tune those we'd like to do that.

And then also there currently is a requirement for coatings to meet an ASTM standard that was specifically designed for elastomer coatings. And we've had comments that is potentially restricting other players in the -- other coating players in the market.

And we'd like to have some advice on whether we need to refine those requirements. Is there a counterpart that applies to other code type non elastomer coatings, for example.

So as long as you're asking CRRC to review stuff, it would be good to get comments on all of that.

MR. HOROWITZ: I'd be glad to be your conduit, and Hashem is ex officio member of our board, so you've got the two people to help you.

Thanks.

MR. ALCORN: Thank you. We have a comment from a person in the back.

MS. VONDRAN: Hi, I'm Michelle Vondran with the BASF Corporation. And I'm also speaking on behalf of a lot of our customers who are roof contractors and installers.

COMMISSIONER ROSENFELD: Can you yell into the mike?

(Laughter.)

COMMISSIONER ROSENFELD: Put the mike a little closer.

MS. VONDRAN: I have three points or issues that I'd like to bring up, and two of them I think are a little complicated and in depth, so I don't expect any kind of resolution here today. I just want to get them out on the floor for thought and discussion.

First I'd like to say that we, as a company, strongly support incorporating steep slope residential and commercial roofing into a cool roof program at some point. And we would like to be part of that initiative and help in any way that we can to get that going.

We think that that's a huge segment of the roofing market, and would contribute greatly to reducing energy consumption and heat island effects in the future.

Second, my issue has to do with the exception that was made for clay tile and cement tile, where they can have an initial reflectance of .4 or 40 percent. I'd like to know how that came about and what someone would have to do to get that same exception for their product that's not clay tile.

We feel that -- we make metal coatings, and we make metal tiles and shingles that have the same air space underneath them, and we feel that they would also fall under those same exceptions.

My third issue is a little bit, probably the most complicated issue I have to bring up. And this has to do with the aged reflectance values. You're going to allow a drop to .55, or 55 percent over three years.

I can currently demonstrate, and so can any other coil coating manufacturer out there that our -- 500 fluorocarbon technology with 15 years exposure at test farms, which we currently have 100,000 panels on the fence in south Florida, there's absolutely no reduction in solar reflectance over that time period. And in most cases, the solar reflectance increases over time.

So we think that there needs to be an exception on the age data. If you're going to allow a product to drop to 55, yet our product is not going to drop at all, why can't we start at 55 or 60 or 65 instead of 70 percent.

And BASF, and I know some other industry leaders would be more than happy to provide this data; show you the panels; show you the test results. If you want outside labs to confirm it, we're more than happy to do that. We know that this is the case, and it's not going to be called into question.

Those are my comments.

MR. ALCORN: Great.

DR. AKBARI: May I respond to the third comment that Michelle made. I think that when CRRC is fully operational within a couple of weeks or so, and we will be having all the age data within three weeks, then we would be using --

MR. HOROWITZ: Three years.

DR. AKBARI: Yeah, I'm just trying to --

MR. HOROWITZ: Okay.

DR. AKBARI: -- be a little bit optimistic here. Then we would be using all those data the way that it is coated.

At this time the reason that we have that 55 percent, it's only for the low slope roofing for that, the type of materials that we have data and we have come up to those numbers.

Actually there are some other people who would argue that the drop might be a lot more than that. And there are others who are saying that, as yourself, that the drop may not be as that much.

So, it appears that we are in the right place on that 20 percent reduction --

MS. VONDRAN: Yes, but what I'm saying is I can demonstrate to you today, if you'd like, because I have the information with me. We don't need to wait the three years. We have 15 years of test farm data that demonstrates this. Why should we have to retest 100,000 panels over the next three years, when we already have the data?

This is a huge expense; and we spend a lot of money for these test farms every year. We're saying that perhaps there needs to be an exception now for those of us, not just BASF, but anyone who can currently demonstrate that no, our product is not going to drop that much.

So why can't we start at 60 percent? Why can't we start at 65 percent when it's not going to drop at all.

DR. AKBARI: One last question before I shut up. Are you asking is that, you know, the entire process that is changing the title 24 is being proposed is that the numbers will be provided by CRRC.

Are you suggesting to exclude that process all together?

MS. VONDRAN: No. This is also an issue that's going to be brought up in June at the CRRC meeting; no one's aware of this. This is an issue that we have discussed with CRRC and are trying to work out, you know, why do we have to wait the three years when we already have the data.

DR. AKBARI: So we know if you come with CRRC and Commission to take your advice, who am I to be against it.

MS. VONDRAN: But that's two issues. I mean, okay, the CRRC agrees that, yes, we can provide our age data now, that's one thing.

What we're saying is perhaps the specs should be different for those of us who are not going to drop in solar reflectance. If you're going to allow a product to drop from 70 to .55 in three years, and we're saying that our product that starts at .55 is not ever going to change, why shouldn't it still qualify for this new specification for cool roof.

DR. AKBARI: Is your product for low slope roof?

MS. VONDRAN: Yes, both. We do steep slope and low slope work.

MR. ALCORN: Okay, -- Noah, one.

MR. HOROWITZ: Very quick clarification. People are talking about a 20 percent reduction. I think what we mean is .20. If you're going from .75 to .55, that's a lot more than 20 percent.

So, do we mean .20 for the degradation, or do we mean 20 percent?

DR. AKBARI: We go from .7 to .55, that's about 20 percent reduction.

MR. ALCORN: Okay, thank you. Art.

COMMISSIONER ROSENFELD: I'd like to ask Noah, Mr. Council, if an industry was forward-seeking and -- forward-looking, and went out and did these tests, I mean if we believe Michelle, it seems that what she's saying makes a lot of sense. Why should they have to wait? They've already certified their product.

I mean they've got to convince you, but --

MR. HOROWITZ: Not me, personally, but the organization.

COMMISSIONER ROSENFELD: But, the Council, right.

MR. HOROWITZ: Yes. Where we are now is we finally agreed that yes, we will go after three year -- to get age data we're going to use three years as our proxy, rather than trying to come up with some accelerated aging test method that we can't do successfully.

So the notion is we'll have test farms and one particular segment of the industry says hey, wait, we've already got this data, so why do we need to wait for three years.

So the board needs to decide, do we grandfather is probably the wrong word, but do we allow them to start using the three-year data now from their own test methods, or does everybody have to start from time to equal zero under the same exact conditions. And I don't know where that will play out.

Charles, you've been involved in a lot of these discussions. Do you have any additional words?

MR. ELEY: Charles Eley, Eley Associates. Thanks, Noah.

(Laughter.)

MR. ELEY: I think you've said it all.

MR. ALCORN: Bob.

MR. SCICHILI: I'm Michelle's associate; my name is Bob Scichili. I'm the Product Development Manager for BASF. And have had this same discussion, fortunately, ad nauseam, I guess, at the CRRC meetings.

But one point I want to make to you is this, to back up what she is saying, and obviously we collaborated before she said it, but the fact that you're asking, and we appreciate your comments, to support by asking the question.

I'm going to say something back to you in support of the fact that you asked the question. The CRRC and anybody who will listen to us has been told that this data that we have, that PPG has, that Valspar has, that AXO has, anybody who makes a quality, high performance coating -- this particular case, these test farms are independently run.

Once we send the panels down, and the panels are not just probes, and they're not just laboratory done for the sake of sending a laboratory panel down there. They represent a batch of paint that's been shipped to various and sundry fabricators, building companies, whatever. And those represent buildings that are out there, okay.

The panels then are done under ASTM testing, whether they be washed and measured for gloss or for chalk or for fade. In this case now we're starting to ask them to do reflectance and emittance.

These are independently reported results that we cannot alter. We don't see the panels when they're done by them, I'm talking about the testing is being done.

So what you're seeing here, and the cost that's being paid out by our company and others, 100,000 panels represents about $600,000 to $700,000 worth of cost, okay, at this point. That doesn't count the reflectance and the emittance testing that has to be added to that. Which we're glad to do because we have an excellent product that will do that, okay.

The fact that those things are then sent back to us, they are our property, and the panels when they're done being tested are then sent back to us. In the case of sending, we did a presentation to the EnergyStar people to do this very thing, okay. To show them that there are buildings represented by panels with independent testing that have these kinds of certifiable results, okay.

Bottomline is they are independent testing. They are paid for, yes, by us. But they don't alter the attitude or the result of the tests that's being done, in this case happens to be Atlas, I'm sure you're familiar with that company.

So I just want to make that clarification. This is not our testing that's being done, I know you have a heavy restriction as it relates to that. And we don't quarrel with that. We don't want anybody asking us on the building side of the business well, where was this testing done, in your laboratory. No, it's being done independently. Here are the results. And we can certify them if that's necessary.

So, we thank you.

MR. ALCORN: Thank you for those comments. Thank you, Hashem. I see Nehemiah has a --

MR. STONE: I'll make it really short. I don't want to call in question anybody's integrity, any company's integrity, the integrity of any testing, but you know, I was there at the beginning of CRRC, I was there at the beginning of NRDC -- oh, excuse me, --

MR. HOROWITZ: Good for you.

(Laughter.)

MR. STONE: Excuse me, not NRDC, NFRC. And there's just like what you have to deal with here, Commissioner. There's an awful lot of politics that goes into decisions you make in addition to the technical correctness.

And I would be very careful encouraging members of the industry to push for something that they did before the industry came to agreement about this is how we're going to do it in a fair, accurate and credible manner. To have their testing accepted.

It makes it difficult to maintain the balance of pulling together the industry around all the disparate issues that you have to pull together. That doesn't mean that BASF has done bad testing. Or that their results are anything less than 100 percent correct.

It just means that whenever you make a change there's winners and losers and sometimes even making the best products have to swallow a little bit of loss.

COMMISSIONER ROSENFELD: Well, luckily I'm not on your Boards.

MR. STONE: I'll get down off my soapbox now. Sorry.

(Laughter.)

MR. PENNINGTON: In general I agree with -- I'm not sure I agree with every bit of that, but I agree that what the Commission has been trying to do is to get to a point where we have an independent organization that's doing a certification process.

That, you know, the process is fully developed and supported throughout the industry. And so it's an independent organization that's doing the certification.

And we had to settle for less than that to get cool roofs, you know, onto the playing table here, playing field here. But, you know, I don't like the idea of continuing that at certain situation for this new parameter. It makes me uncomfortable.

MR. ALCORN: Okay. Hashem, thank you for that presentation.

DR. AKBARI: I did my job by reducing my presentation to seven minutes. It's all the other people who want to talk.

(Laughter.)

MR. ALCORN: Thank you for that. We're going to move on now to the final measure report which is hydronic system measures. And the presenter for this topic if Mark Hydeman from Taylor Engineering. Mark.

MR. HYDEMAN: Thank you, Bryan. I'm Mark Hydeman from Taylor Engineering. I'm one of the consultant team that's developing measures; we're the lead on mechanical measures for the California Energy Commission.

According to the schedule I'm now finished with my presentation, are there any questions?

(Laughter.)

MR. MAHONE: Thank you, Mark.

MR. HYDEMAN: Yes. Anyway, we're talking about -- widgets, the sort of stuff that mechanical engineers are interested in.

Next slide, please. There are five independent measures under this paper and I'll get to each of these individually in a moment. But I want to point out they're based largely on ASHRAE standard 90.1, 2001, and there's a reference for the section number.

Next slide, please. First measure has to do with variable flow. This is basically for chilled and hot water systems only. We're saying that you can't have all three-way valves on chilled and hot water systems. You must have some number of two-way valves. We'll get into what that number is.

And we are not requiring, I want to make absolutely sure people realize we are not requiring primary, secondary or variable flow primary systems with a controlled bypass. Although generally in our own designs we find that those are the right ways of dealing with the variable flow issue.

But there's some complexity there and there's some costs there, and there's ways of going without doing either of those things and still creating a semivariable flow system.

We permit the use of some three-way valves to maintain minimum flow through primary equipment. That would be through boilers or chillers. And you can also use pump staging as opposed to putting variable speed drives or riding the pump curve to meet the 50 percent flow reduction.

Next slide. Here's our cost analysis. Two-way valves are cheaper than three-way valves installed, period. That's a fact.

Variable flow always saves energy whether or not you put a variable speed drive on the pump or ride the pump curve. Therefore, the measure costs less, saves energy, it's immediate payback.

Next slide. And here's the language. This is a proposed prescriptive measure, all five of these are proposed prescriptive measures. And we're basically saying that HVAC chilled and hot water pumping systems shall be designed for variable flow, and shall be capable of reducing pump flow rates to no more than the larger of, and basically either 50 percent flow or the minimum required to protect the equipment.

And the exception is the system is very small. It has no more than three control valves. It can have all three-way valves. The thought there is that there'd be very low head system in there for not a lot of pumping energy to save.

This is the second measure. We're going to talk about isolation of chillers and boilers. This is kind of an odd duck that's out there, mostly in design built practice, but it's just a couple of isolation valves that can save an awful lot of energy.

Permits better staging of chillers and boilers at part load. Requires isolation valves for chillers, boilers when the pumps are headered. And if they're dedicated pumps they will meet the requirement. The next two slides will show what these look like.

Next slide. This is what happens when you have pumps that are headered basically. They're joined together so that any pump can run with either piece of equipment. This is a manual arrangement, which, if you have this manual arrangement there's no way automatically to stage one of these chillers or boilers off. Therefore, they both have to run at all times that the plant is operable, unless somebody physically goes there and squishes down the valves.

That's very inefficient. What we're requiring is an automatic control valve. So that's the only item that costs, and the energy savings are based on running instead of two chillers or boilers all the time, being able to stage one off.

Next slide. If you have dedicated pumps, which is often done, this automatically comes with it, because when you stage a pump off, this whole circuit is hydraulically isolated from that using the check valve. So that would be permitted.

Next slide. We did the analysis for chilled water systems in climate zone 12 and 3. The reason we only used two climate zones obviously we're on a very tight deadline, and with limited funds.

These really represent the range of the climates, and they're also the two climate zones that have the largest construction activity. So they represent a large part of the construction activity, plus they bracket virtually all the climates in the state.

In climate zone 12 you can see the breakdown here. The chiller energy's at the bottom. In the middle is the tower energy. At the top if the pump energy. This is with isolation; this is without isolation. Without uses more energy because you're running the chillers and boilers -- in this case the chillers, way down on their performance curves. And this is in climate zone 3.

Next slide. This is what the life cycle cost analysis looks like. We actually performed this analysis at 100-ton, 200-ton and 300-ton plant. Below 100 tons it's very rare that you'll find multiple chillers anyway. So we figured we were down at the low end of the spectrum. It's all positive net present value to put in those isolation valves.

Next slide. Hot water very similar. Climate zone 12, climate zone 3. With isolation; without isolation. Just the boiler energy.

Next slide. And it has very similar shape. In this case it actually zeroes out at about 200 kBtuh. But again, in that small a plant you'd rarely have two boilers. It would probably just be a single boiler on the roof.

Next slide. This is the proposed language for chiller isolation. Basically says you're required to have the means to automatically shut off the chiller. Plant shall be designed to make sure that it can operate stably when just one chiller is on.

And we do not consider two chillers that are piped in series to be independent pieces of equipment, because they must, by the nature of that design, when you have a series arrangement, run water through both chillers.

There are ways to pipe it such that you can run one or the other, but it gets quite expensive. It's kind of the oddity. And so we are making an exception for that.

Boilers are the same thing, but you never see the boilers in series, so there's not that exception.

Next slide. This is the third one. We're talking about chilled water and hot water supply temperature reset. Get chilled and hot water constant volume systems only. In a variable volume system we have a variable flow. If you reset the temperature upwards, you're going to pump more water, and you actually end up losing that battle that the pumping energy will often out-weigh the chiller or boiler energy.

Reset can be done either by outside air or some representative building load, like return temperature or load. And it's not required for variable flow systems.

Next slide. We did analysis in climate zones 3 and climate zone 12. The only cost to this is really programming, some level of programming. And so we threw in $1000. And these would be the threshold plant sizes, seven or eight tons in the case of chilled water; and only about 500 kBtuh in terms of hot water systems where reset would be cost effective.

Next slide. And so we're requiring it in chilled and hot water systems. And then the exception is for systems that have variable flow to reduce pumping in accordance with, and that'll be the last measure that we'll talk about.

Okay, this is an interesting measure. There are a lot of water source heat pumps or what's known as the California heat pump system out there. The manufacturer's offer is a standard, a little valve that you put inline with the heat pump that cycles on and off with the compressor. And that makes it a variable flow system.

So if the system is in heating or cooling, any time that compressor is engaged, the valve opens, flow goes through the heat pump. Otherwise you shut it off and you've got a variable flow system.

We are also requiring in conjunction with this, variable speed drives on the loop pumps.

Next slide. We did analysis for a number of plant sizes going from three horsepower loop pumps all the way up to 30 horsepower. We had to make some assumptions about how many one-ton heat pump units, how many three-ton heat pump units, how many five-ton. So we came up with this breakdown of 50 percent one-ton units, 30 percent three-ton, 20 percent five-ton based on our experience in doing design with these types of systems.

And having done that we could actually add up the valve costs for the various sizes of units, because the valve costs scale with the size of the piping that they're associated with.

We ran the systems both with and without variable flow using EQUEST and we came up with a total cost and net present value of the savings. And it was cost effective all the way down to five horsepower.

Next slide. So we're requiring water loop heat pump systems where the loop pumps have five horsepower more to have variable speed controls.

And all of this text here repeats text in the next measure, so we have alternate language here -- next slide -- that just refers to the next measure, if that next measure is adopted. So this is the cleaner version.

Next slide. Okay, finally we'll talk about variable speed drives. In the first measure we talked about variable flow systems, but there we evaluated it riding the pump curve. Here we're saying where does it make sense to add a variable speed drive.

Note this is only for chilled and condenser water systems. Heating hot water systems are not on there because in hot water systems the extra heat generated by riding the curve actually has a beneficial effect. It adds heat into the system; it reduces the amount of heat required by the boilers; and even though it's electric heat, it does actually skew the life cycle cost analysis.

And in our experience we found that in fact we can't justify variable speed drives on heating hot water systems.

Next slide. This shows that we did the analysis again in climate zones 3 and 12. We have different reset schemes, whether you reset by valve demand or you have a fixed differential pressure sensor out there in the system.

We ran it both ways. But you note that it's really cost effective below 5 horsepower for all systems.

Next slide. And so we required it at 5 horsepower. And we didn't redline in variable speed drives. We basically said, here's the functionality of a variable speed drive. It draws no more than 30 percent full load kW at 50 percent flow. So if someone comes up with a mechanical drive that does the same, so be it, they can meet the requirements of the standard.

Next slide. Bingo, do I get a gold star?

(Laughter.)

MR. ALCORN: Yes, I say you do.

(Applause.)

MR. HYDEMAN: With that I'll open it to questions.

SPEAKER: I think you beat a record.

MR. HYDEMAN: That's because they're all asleep from all those architectural measures.

(Laughter.)

MR. ALCORN: We have a question from Steve Gates.

MR. GATES: Mark, I had a question on the exemption for variable flow systems with -- for systems having less then three control valves.

The assumption there is that it is a small system, is that right? Or is it any system? For example, I've designed systems before that simply had one air handler, but it was 75,000 cfm or so. So it was basically a large load, but one control valve.

MR. HYDEMAN: There are two issues here, Steve. We've designed lots of systems with one chiller, one air handler, and there we have no control valves. We typically control it off the discharge temperature of the -- use a variable speed drive and control it off the discharge temperature from the air handling unit.

But if you have a couple of air handling units, the concept is one of two things. One is it's probably relatively close coupled, and therefore the head on the pump is relatively small.

The other issue is that we have to provide some minimum flow through the chillers or boilers, in which case you're going to allow one or two of those three valves to be three-way anyway. And so it may be that we're chasing after kind of the bottom of the barrel, if you will.

You want to make sure that there's some provision there for systems that have low pump head for which there's not going to be a lot of pump energy savings. And also, you know, for the fact that again we can capture all these systems, but we want to make sure the language is kind of as clean as possible.

So those were our thoughts. And this is consistent, by the way, with 90.1. They made the same decision.

MR. ALCORN: Tony Pierce.

MR. PIERCE: Tony Pierce with Southern California Edison.

Mark, I was interested on your reset controls analyses. If you have any plans to run those on a desert climate, 14 or 15?

MR. HYDEMAN: We could certainly do that if you think that the results would be tremendously different.

MR. PIERCE: No, just they look so good. I was wondering if they'd look even better, at least on the chiller.

MR. HYDEMAN: Yeah. If it would be useful I'd be glad to run them offline and give you the results.

MR. PIERCE: We can talk about that.

MR. HYDEMAN: Yeah.

MR. ALCORN: Mark, okay -- yeah, Nehemiah.

MR. STONE: Two questions and I may not need to ask the second one depending upon your answer to the first one.

Are all of the boilers you're talking about on this just dedicated for hydronic, or are they providing service water heating, too?

MR. HYDEMAN: I see very few boilers here that are actually combination heating and service water heating boilers. Some of the boilers you can get those little heat exchangers for service water heating. But typically we see service water heating is dedicated.

MR. STONE: Forget the second question.

MR. HYDEMAN: You do see a lot of that in New York. That was a big problem, 90.1 grappled with that forever.

MR. ALCORN: Okay. Are there any other questions for Mark, or any comments generally?

Excellent job.

Thank you, all, for the very valuable input today and enduring this. It was a good day.

Thanks much. We're going to adjourn right now.

(Whereupon, at 4:50 p.m., the workshop was concluded.)

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CERTIFICATE OF REPORTER

I, VALORIE PHILLIPS, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 19th day of June, 2002.